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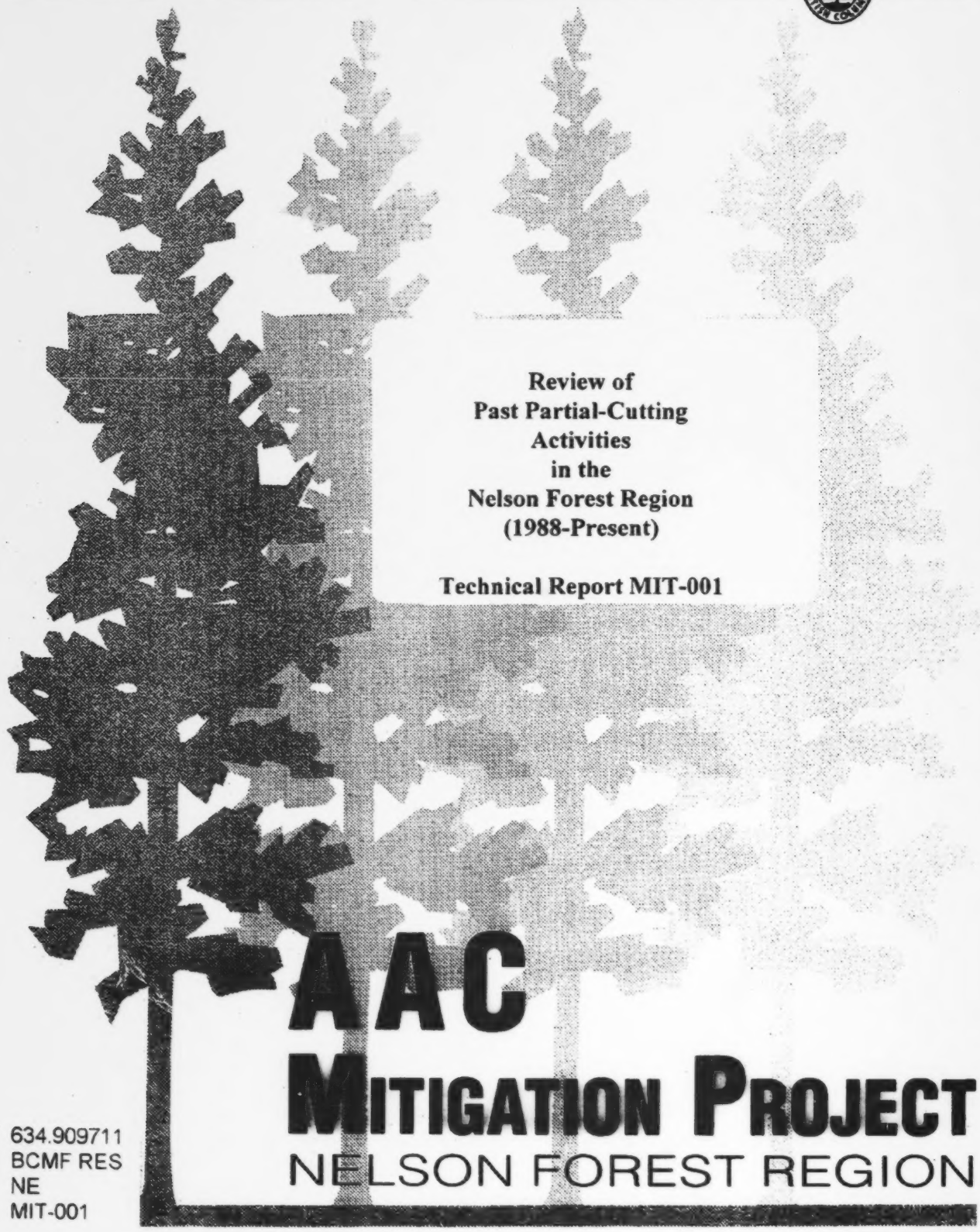

Review of
Past Partial-Cutting
Activities
in the
Nelson Forest Region
(1988-Present)

Technical Report MIT-001

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Review of Past Partial-Cutting Activities in the Nelson Forest Region (1988-Present)

Technical Report MIT-001

Angela Hawe, RPF

June 25, 1996

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EXECUTIVE SUMMARY

This is one of a series of reports detailing the potential for partial cutting to mitigate the allowablw annual cut (AAC) reductions indicated by the latest round of Timber Supply Reviews conducted in the Nelson Forest Region (NFR). This report is a background analysis of the use of partial-cutting systems by both licensees and the Small Business Forest Enterprise Program (SBFEP) in each district, from 1988 to the present.

Partial-cutting silvicultural systems are seen as having significant potential for mitigating AAC reductions by reducing the impact of two key constraints on harvest levels: adjacency rules and non-timber values. The purpose of this report is to provide a clear picture of where we stand now in terms of partial cutting in various districts and forest cover types throughout the region, so that we can identify opportunities for increased use of these systems in the future. The increased use of various partial-cutting systems will allow short-term increases in wood supply through greater flexibility of harvest scheduling, as well as long-term increases in wood supply through access to highly constrained areas that would otherwise be unavailable for harvesting.

The analysis was conducted using information obtained from the Integrated Silviculture Information System (ISIS) and Major Licensee Silviculture Information System (MLSIS) databases for the seven districts in the Nelson Forest Region. The analysis generated a number of interesting results in terms of logging patterns over the past 8 years. It also raised a number of issues about the collection and tracking of silvicultural systems data.

In terms of results, three of the seven districts in the region (Golden, Kootenay Lake, and Revelstoke) do very little partial cutting and the remaining four districts (Arrow, Boundary, Cranbrook, and Invermere) use quite a variety of the silvicultural systems. However, closer examination shows that, even in the districts with greater use of partial-cutting, the majority of silvicultural systems used are low- or no-volume retention ones (clearcutting or seedtree cuts) with much less representation of higher-volume retention systems such as uniform shelterwoods or single-tree selection cuts. Even in forest types (analysis units) where high-volume retention partial cutting is commonly used, there are often substantial amounts of clearcut and seedtree systems used.

Another interesting trend seen in the analysis is that the cutting profile of the Small Business Forest Enterprise Program over the past 8 years has included a greater proportion of higher-volume retention silvicultural systems (on an area basis) than the cutting profile for licensees. However, in both cases, there is substantial room for increased application of alternative partial-cutting systems that retain more volume. Greater application of these systems (various types of shelterwood and selection cuts) could be a very useful tool in mitigating the effects of various harvesting constraints including adjacency rules and non-timber values.

Discussions with a number of licensee and Small Business Program foresters throughout the region in 1995 suggested that the introduction of the Forest Practices Code would

likely be a catalyst leading to greater use of non-clearcut silvicultural systems. Many of the foresters interviewed indicated that they were already beginning to develop more and more partial-cutting prescriptions. Therefore, the numbers presented in this report may not be truly reflective of the degree of partial cutting being done currently, and this should be kept in mind when reviewing the summary tables provided in the report.

Root disease concerns appear to be a significant factor limiting the application of partial-cutting systems on a more widespread basis in some districts (Golden and Kootenay Lake). However, in other districts partial-cutting systems are applied in a wide variety of analysis units / biogeoclimatic subzones, even those indicated as being high-hazard areas according to the Root Disease Management Guidebook (Arrow, Invermere).

In several districts there are concerns about whether or not it is feasible or appropriate to partially cut overmature forest types. Revelstoke and Kootenay Lake in particular have significant areas of overmature cedar-hemlock forest types that may present problems for some forms of partial cutting. Options for these types may be limited to systems such as group selection; however, other systems could be tested on a small-scale, trial basis to determine suitability.

It is important to caution that although a variety of silvicultural systems have been used in various forest types, in various districts, there has been little work done to judge the success of these treatments in terms of regeneration, post-harvest stand structure, susceptibility to disease, rates of growth, or other parameters that may be of interest to forest managers and that may have implications for future harvest levels. If the increased use of higher-volume retention partial-cutting systems is to be promoted, an extensive retrospective study needs to be undertaken in each district to determine the success of various systems to date in the different analysis units in which they are applied. It is especially important to monitor the success of partial-cutting systems that are applied in analysis units in which they are rarely prescribed. Other critical areas in which a range of partial-cutting systems need to be tested include higher-risk root disease areas, and old/decadent forest types. This will help determine the potential for the use of various systems in situations for which we have little past experience. Results of small trials in areas such as these can then be extended to other districts or licensees with similar forest types and similar management problems.

The issues raised by the analysis in terms of data collection and tracking stem for the most part from database deficiencies that became obvious part way through the process. These deficiencies include substantial amounts of missing information in certain fields, outdated information, incorrect or questionable data, and occasional missing records. The most significant of these for the purposes of this report is likely the incorrect or questionable data, specifically with regard to silvicultural system nomenclature. Often the MLSIS or ISIS label applied to a silvicultural system for a specific cutblock did not correspond to the treatment described in the prescription for the block. Unfortunately, a manual verification of all the records in the silvicultural system data field was not possible and the analysis was completed using the information at hand.

In order to improve the results of future Timber Supply Reviews, it is critical that, wherever possible, they be based on accurate and comprehensive information about past and current harvesting activities, rather than on assumptions. This will provide modellers and analysts with a reliable picture of where we stand at present so they can more successfully model future timber supplies and develop appropriate cutting levels.

In general, this analysis showed that districts that currently use little partial cutting (Golden, Revelstoke, Kootenay Lake) may have good potential for increasing the application of partial-cutting silvicultural systems, and therefore mitigating AAC reductions. However, even districts that currently use a variety of silvicultural systems throughout their land base (Invermere, Cranbrook, Boundary, Arrow) have potential for additional use of alternative silvicultural systems. These districts generally use either clearcut systems or low-volume retention systems (seedtree) on more than 50% of their land base. These systems do not help reduce adjacency constraints, and generally are not considered appropriate for protecting non-timber values. A shift towards lower proportions of these systems will allow the districts more flexibility in harvest scheduling and more access to highly constrained areas.

Districts with a greater proportion of high-volume retention silvicultural systems may also tend to have a greater area logged because, in order to remove an equivalent volume, more area must be harvested than would be required with clearcut systems. This has a number of implications including increased initial development costs, increased harvesting costs, and increased maintenance costs. These disadvantages must be weighed against the potential benefits of a shift towards more partial cutting. In general, a good mix of systems is likely the most effective option, with considerable attention given to where each system is applied. Harvest schedule models would be a very useful tool for achieving this and would provide a much better overall development plan than that provided by planning and prescribing on a block-by-block basis.

1.0 INTRODUCTION

This is one of a series of reports detailing the potential for partial cutting to mitigate the allowable annual cut (AAC) reductions indicated by the latest round of Timber Supply Reviews conducted in the Nelson Forest Region (NFR). This report is a background analysis of the use of partial-cutting systems by both licensees and the Small Business Forest Enterprise Program (SBFEP) in each district, from 1988 to the present.

Partial-cutting silvicultural systems are seen as having significant potential for mitigating AAC reductions by reducing the impact of two key constraints on harvest levels: adjacency rules and non-timber values. The use of partial cutting could lead to short-term increases in available wood suppy by allowing access to areas that would not otherwise be available for harvest due to adjacency to non-greened-up clearcuts. Though this will not increase the overall volume of wood available over time, it will alter the timing of wood availability, providing greater flexibility for harvest planning. In the long term, partial cutting may allow access to parts of the land base where non-timber values restrict the use of clearcut logging. This should result in an increase in the overall volume of wood available over time.

In order to quantify the potential impacts of partial cutting on harvest levels in each district, we need to establish a baseline of past partial-cutting activities (including the amount done and the forest types in which it was done), the potential for partial cutting in other forest types, and accurate yield curves to represent these activities in the Timber Supply Analysis for each district. This report will describe the first of these items–partial-cutting practices over the past 8 years in each of the districts in the NFR. The other topics will be covered in subsequent reports.

2.0 METHODOLOGY

An analysis of past cutting practices (1988 to the present) was conducted for each of the districts in the NFR (Arrow, Boundary, Cranbrook, Golden, Invermere, Kootenay Lake, and Revelstoke). The analysis covered the activities of the SBFEP and the various licensees (both major and other) in each district.

2.1 SBFEP

For SBFEP activities, the analysis was conducted using data from the Integrated Silviculture Information System (ISIS) database. This information base is considered to be the most up-to-date and complete available (with the exception of visiting each district office and doing a very intensive and time-consuming search of all opening files). All the information fields required for this analysis were available from standard ISIS reports. For each district, three reports, OPNR 001 (cutblock information), OPNR 005 (harvest

information), and OPNR 007 (ecological information), were downloaded as text files, converted into ACCESS database files, then merged into one report for each district using opening number as the common field. These reports included all logging with a harvest start date of January 1, 1988 or later, and included silvicultural system, biogeoclimatic and previous timber type information, as well as general opening information such as area, site class, and harvest date.

There are some inconsistencies in the ISIS reports, and a small number of records were rejected during the merging process because matching records were not available in all three reports. For example, the record for opening 82E030.210 may only have been found in two of the three ISIS reports and therefore would not have been included in the merged report for the district in question. Up to 15% of the records for some districts were rejected for this reason. (However, when losses were this high, as with Golden District SBFEP, attempts were made to do some of the analysis with the larger dataset.) In general, loss of records during merging was limited to 5%.

Once the OPNR reports for each district were merged using ACCESS, the database files were transferred to EXCEL spreadsheet format for analysis. Data were found to vary considerably from district to district, with some districts showing very complete information for most records (openings) and others having numerous incomplete records, especially in fields such as silvicultural system, previous forest type, and site class. These incomplete records were retained in the database but are summarized as "unspecified" for the incomplete categories.

Data for each district were analyzed by analysis unit where possible (an inventory, and, in some cases, landbase constraint, grouping used in the Timber Supply Review [TSR] process to model similar types together), and by biogeoclimatic subzone/variant for each silvicultural system. Analysis unit (AU) classifications are district-specific and classifications for each opening were generated using the previous type information and AU descriptions provided in the Timber Supply Analysis reports for each district (see Appendix 1). In two districts (Kootenay Lake and Golden) district-specific AU classifications are not based solely on forest types but incorporate both forest type and site constraint information such as visual sensitivity, community watersheds, and winter range. For Golden District, the analysis of silvicultural systems was done by forest cover grouping (a four-class system unique to this district) (see Appendix 1) as well as by biogeoclimatic subzone/variant. For Kootenay Lake District, the analysis of silvicultural systems was done by both biogeoclimatic subzone/variant and by AU; however, in this case the AU classifications used are based on the Nelson Regional Protocol for Establishing Analysis Units (see Appendix 1) rather than district-specific ones. For all districts, the biogeoclimatic information received from ISIS included a mix of new and old classification systems. For the purposes of this analysis, the old listings were converted to the new classification system. The results of the silvicultural systems analysis by biogeoclimatic classification are presented in Appendix 2.

2.2 Licensees

Past cutting practices information for licensees was obtained from the Major Licensee Silviculture Information System (MLSIS) database. This database includes information for Tree Farm Licenses (TFLs), Forest Licenses (FLs), and a variety of smaller licenses including Woodlot Licenses (WLs). The information was analyzed as a single unit for each district, rather than by subdividing it into individual licensees or types of license. Information requested for the analysis was the same as for the SBFEP analysis, that is, general opening, silvicultural system, and biogeoclimatic and previous forest type information for the period from 1988 to the present. No standard report was available that included all the required data fields, so a custom report was compiled for the Nelson Forest Region by technical analysts from the Ministry of Forests Business Design Branch in Victoria.

The initial report received from the Business Design Branch was based primarily on information taken from the Cutblock Table of the Forest Tenure Administration System (FTAS) database. This information is submitted at the start of harvesting activities. An initial review of the information revealed substantial amounts of missing data, particularly in the silvicultural system, site class, and previous forest type fields. A subsequent query produced much more complete listings for two of these fields–silvicultural system and site class–taken from the MLSIS Denudation Activity Table (compiled from the Form B information submitted by the licensee at the completion of harvest) and Forest Cover Table, respectively. Unfortunately, more complete previous forest type information was unavailable since this information is submitted voluntarily only (it is not a required field in the MLSIS reporting system), so it generally was incomplete. As this information is critical for determining the analysis unit each cutblock represents, summer co-op students were sent to five of the seven districts in the NFR to obtain this information from individual opening files. Given the large numbers of openings involved, students collected only a sample of information for each district, and concentrated mainly on partially cut blocks. Little partial cutting has been done in either Revelstoke or Golden districts, so this information was completed by district staff for all partially cut blocks. Previous forest type information for clearcut areas in most districts is quite limited, given the decision to manually sample predominantly partially cut openings (in order to better characterize where partial cutting is being done). However, it is likely that clearcut logging takes place to some degree across most or all AUs in each district, so this information is not critical to the completion of this report.

As with the SBFEP ISIS information, FTAS and MLSIS information for each district was downloaded as text files, converted into ACCESS files for initial sorting, then exported to EXCEL spreadsheets for analysis. Analysis of the data and comparison of the data from different sources (FTAS or MLSIS Form B) showed a number of discrepancies within the database. The most serious of these was the frequent inconsistencies between the silvicultural system listed for a specific opening in the FTAS database and that shown for the same opening in the MLSIS database. Business Design Branch analysts had no explanation for this, though they suggested that the Form B information is likely the most

reliable since it is submitted by the licensee at the completion of harvest activities, and therefore should be correct. However, a review of a very small sample (1–5%) of Pre-Harvest Silviculture Prescriptions (PHSPs) and Silviculture Prescriptions (SPs) for each district showed that even the Form B listing for silvicultural system sometimes differed from that indicated in the prescription. The information provided in the MLSIS Form B database was used in the analysis except where manually verified information was available.

A small number of openings were found in one or other of the databases (FTAS or Form B), but not both. This can be explained partly by the fact that the FTAS database was generated using a harvest *start* date of January 1, 1988 whereas the MLSIS Form B database, which is based on the completion of harvesting, was generated using a harvest *end* date of January 1, 1988. Therefore, blocks that were either started before 1988 but not finished until 1988 or later, or the blocks started in 1995 or 1996 but not yet finished, would show up only in one or the other of the two databases. However, for each district, there were a small number of blocks (between 1 and 5%) that should most likely have appeared in both listings but did not (e.g.,, started in 1988 or 1989 but not yet shown as completed [no harvest end date], or shown as completed in 1994 or 1995 without having any record of being started [no harvest start date]). The analysis incorporated as many of these blocks as seemed reasonable.

The biogeoclimatic information obtained for many of the openings was based on the old classification system in use when many of these blocks would have been logged. Where possible, these listings were converted to the new classification system; however, for a large number of subzones, no direct conversion was possible without obtaining elevation and location information, then spending substantial amounts of time (given the large number of blocks in question) looking through ecosystem classification maps. In these situations, old system nomenclature was used.

As for the SBFEP analysis, data for the licensees in each district were analyzed by district- specific analysis unit where possible and by biogeoclimatic classification. The two exceptions to this were Golden, which was analyzed by biogeoclimatic subzone/variant and forest cover grouping instead of AU, and Kootenay Lake, which was analyzed by regional analysis unit classifications.

3.0 RESULTS

The analysis indicates substantial differences in the use of partial-cutting systems among the various districts in the NFR, and between the SBFEP and licensees in each district. To a large extent this is probably due to forest type differences; however, it is likely that (to some degree) the differences are also the result of personal experience and management styles. A summary of past-partial cutting practices, by AU, for each district in the NFR is provided below, with separate listings for SBFEP and licensee activities. A

regional summary is provided after the district breakdowns. A detailed listing of all blocks logged in each district since January 1, 1988 is provided in Appendices 3 (SBFEP) and 4 (Licensees).

Results are summarized by analysis unit and by biogeoclimatic subzone/variant for each silvicultural system used. The results of the biogeoclimatic analysis are provided in Appendix 2 rather than in the main body of this report in order to minimize the number of tables presented. As previously discussed, Golden and Kootenay Lake districts follow a slightly different format, providing results by forest cover grouping and regional analysis unit, respectively, rather than by district analysis unit. All results are presented as both area (ha) and percentages. As will be noted, the results for the AU breakdown often include large areas classified as "unspecified." This is the result of the limited availability of previous forest type information.

The AU breakdown is presented in two ways: silvicultural system by AU, and AU by silvicultural system. The first of these tables shows the amount of each system being used and the various analysis units in which each is used. The second presents the same information, organized in a manner that shows more clearly the amount of each AU being logged, and the type of silvicultural system used in each.

3.1 ARROW DISTRICT

3.1.1 SBFEP

According to the ISIS database, approximately 3100 ha were logged in the Arrow District from 1988 to the present. Of this area, 59% was harvested using some form of partial-cutting system. The most commonly prescribed silvicultural system was single-tree selection which was used on 1356 ha (43% of the total area logged). It is likely that much of this logging was pine removal (either lodgepole pine to reduce mountain pine beetle hazard, or white pine to remove trees dying from blister rust). Table 1 shows a more complete breakdown of silvicultural systems used by the Arrow District SBFEP.

A large portion of Arrow District SBFEP logging uses partial-cutting systems. However, either clearcuts or low-volume retention partial-cutting systems are still applied on more than 50% of the logged area, and neither of these systems will meet the criteria required for avoiding adjacency constraints (e.g.,, 40% of basal area remaining after harvest). This leaves an opportunity to increase the use of partial-cutting systems that retain greater volume (shelterwoods, single-tree selection, group selection) in the future. These systems are often more appropriate for meeting non-timber constraints.

It is interesting to note that a large amount of "selection" logging and very little shelterwood logging is shown as being done in the district. Discussions with Al Skakun (Small Business Forester) indicate that most of these areas are in fact shelterwood systems and that very little true selection cutting (e.g.,, uneven-aged management) is done

in the district. The incorrect listings likely stem from the fact that much of the pine removal logging in past years was called "selection logging" because pine were being selected for; however, these blocks are generally even-aged management areas. True selection logging uses an uneven-aged management regime. An "Irregular shelterwood" may better describe these areas since the overstory is being removed in two passes (pine then remaining stems) with a more time between passes than for a traditional shelterwood. The numbers given in Tables 1 and 2 reflect the nomenclature given in the prescriptions and stored in ISIS, and are not necessarily an accurate reflection of the systems used.

TABLE 1. Breakdown of past logging by silvicultural system and analysis unit for Arrow District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit (lead spp. + site)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1 282	41%			
			1 - Fd,Lw,Py - G/M	355	28%
			2 - Fd,Lw,Py - P	14	1%
			3 - Sx - G/M	44	3%
			5 - Hw,Cw - G/M	292	23%
			7 - Pl,Pa,Pw - G/M	352	27%
			9 - Bl (ESSF) - G/M/P	51	4%
			10 - Bl (ICH) - G/M/P	47	4%
			Unspecified	127	10%
Uniform Seedtree	238	8%			
			1 - Fd,Lw,Py - G/M	138	58%
			5 - Hw,Cw - G/M	22	9%
			7 - Pl,Pa,Pw - G/M	68	29%
			Unspecified	10	4%
Group Selection	154	5%			
			3 - Sx - G/M	15	10%
			7 - Pl,Pa,Pw - G/M	49	32%
			10 - Bl (ICH) - G/M/P	90	58%
Single-tree Selection	1 356	43%			
			1 - Fd,Lw,Py - G/M	833	61%
			3 - Sx - G/M	56	4%
			5 - Hw,Cw - G/M	64	5%
			7 - Pl,Pa,Pw - G/M	370	27%
			9 - Bl (ESSF) - G/M/P	8	1%
			10 - Bl (ICH) - G/M/P	2	0%
			Unspecified	23	2%
Uniform Shelterwood	91	3%			
			1 - Fd,Lw,Py - G/M	51	56%
			3 - Sx - G/M	21	23%
			5 - Hw,Cw - G/M	19	21%
Total Logging	**3 121**	100%			

Table 2 shows the same information organized by AU, then by silvicultural system. This indicates how much of the SBFEP logging in the district occurs within each analysis unit and the breakdown of silvicultural systems used in each unit.

TABLE 2. Breakdown of past logging by analysis unit and silvicultural system for Arrow District SBFEP

Analysis Unit	*Area(ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	1 376	44%			
Fd,Lw,Py - G/M			Clearcut	355	26%
			Uniform Seedtree	138	10%
			Single-tree Selection	832	61%
			Uniform Shelterwood	51	4%
AU 2	14	0%			
Fd,Lw,Py - P			Clearcut	14	100%
AU 3	136	4%			
Sx - G/M			Clearcut	44	32%
			Group Selection	15	11%
			Single-tree Selection	56	41%
			Uniform Shelterwood	21	15%
AU 5	397	13%			
Hw,Cw - G/M			Clearcut	292	74%
			Uniform Seedtree	22	6%
			Single-tree Selection	64	16%
			Uniform Shelterwood	19	5%
AU 7	839	27%			
Pl,Pa,Pw - G/M			Clearcut	352	42%
			Uniform Seedtree	68	8%
			Single-tree Selection	370	44%
			Group Selection	49	6%
AU 9	59	2%			
Bl (ESSF) - G/M/P			Clearcut	51	87%
			Single-tree Selection	8	13%
AU 10	139	4%			
Bl (ICH) - G/M/P			Clearcut	47	34%
			Group Selection	90	65%
			Single-tree Selection	2	1%
Unspecified	160	5%			
			Clearcut	127	79%
			Uniform Seedtree	10	6%
			Single-tree Selection	23	14%
Total Logging	**3 120**	100%			

Clearcut systems are used in all AUs; however, most AUs do have some degree of partial cutting. The bulk of the logging occurs in AUs 1 and 7, and both of these units are logged using predominantly partial-cutting systems (mostly single-tree selection according to ISIS, though more likely shelterwoods). An interesting observation from Table 2 is that very few poor sites are logged. It is unknown whether this is because of a limited occurrence of these sites in the SBFEP operating areas or because of a focus of logging efforts on medium or better sites.

3.1.2 Licensees

A total of 32 278 ha were logged by various licensees in the Arrow Forest District between 1988 and the present. This includes logging on Tree Farm Licenses, Forest Licenses, and a number of smaller licenses. As can be seen in Table 3, 85% of this logging was clearcut logging and only minor amounts of various partial-cutting systems were used. A quick comparison of the silvicultural system listings from both the FTAS and Form B databases showed a fairly good match, with fewer than 15% discrepancies. Assuming the Form B information used in the analysis is the most reliable, the numbers presented in Table 3 should be reasonably accurate. A quick check of a small sample of Pre-Harvest Silviculture Prescriptions and Silviculture Prescriptions for the district showed about 75% of the silvicultural systems listings to be accurate, and most of the remainder were not necessarily incorrect, but rather were difficult to verify given the limited information provided.

A very small number of records occurred in either the FTAS database (17 openings) or the Form B database (23 openings), but not both. Given that there are more than 1000 records in the Arrow District Licensee database, these blocks represent a very small fraction of the entire database and do not have a significant influence on the results of this analysis. However, these blocks raise questions about whether or not the regeneration delay period has been flagged for blocks that do not show a harvest start date, and questions about the accuracy of Ministry of Forests Annual Reports, which are compiled from the final Form B database.

As can be seen in Tables 3 and 4, clearcut logging is the predominant silvicultural system used by licensees throughout the Arrow District. However, given the large proportion of unspecified AUs, the actual breakdown by AU for clearcutting is unknown. As with the SBFEP listing, there appears to be very little representation of poor sites in the cutting profile, although this is difficult to say for sure given the large proportion of unspecified AUs.

TABLE 3. Breakdown of past logging by silvicultural system and analysis unit for Arrow District licensees

Silvicultural System	*Area (ha) Logged*	*% Total Logged*	*Analysis Unit (lead spp. + site)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	27352	85%			
			1 - Fd,Lw,Py - G/M	1526	6%
			2 - Fd,Lw,Py - P	30	0%
			3 - Se - G/M	554	2%
			4 - Se - P	16	0%
			5 - Hw,Cw - G/M	843	3%
			6 - Hw,Cw - P	31	0%
			7 - Pl,Pa,Pw - G/M	480	2%
			9 - Bl (ESSF) - All	219	1%
			Unspecified	23652	86%
Group Seedtree	111	0%			
			1 - Fd,Lw,Py - G/M	49	44%
			2 - Fd,Lw,Py - P	15	14%
			3 - Se - G/M	19	17%
			7 - Pl,Pa,Pw - G/M	28	25%
Uniform Seedtree	1090	3%			
			1 - Fd,Lw,Py - G/M	292	27%
			3 - Se - G/M	10	1%
			5 - Hw,Cw - G/M	25	2%
			7 - Pl,Pa,Pw - G/M	363	33%
			Unspecified	400	37%
Group Selection	1931	6%			
			1 - Fd,Lw,Py - G/M	649	34%
			2 - Fd,Lw,Py - P	129	6%
			3 - Se - G/M	102	5%
			5 - Hw,Cw - G/M	127	6%
			6 - Hw,Cw - P	10	1%
			7 - Pl,Pa,Pw - G/M	534	28%
			Unspecified	379	20%
Single-tree Selection	571	2%			
			1 - Fd,Lw,Py - G/M	95	17%
			2 - Fd,Lw,Py - P	46	8%
			4 - Se - P	30	5%
			5 - Hw,Cw - G/M	19	3%
			7 - Pl,Pa,Pw - G/M	65	11%
			9 - Bl (ESSF) - All	104	18%
			Unspecified	213	37%
Uniform Shelterwood (includes natural and irregular shelterwoods)	1054	3%			
			1 - Fd,Lw,Py - G/M	524	50%
			2 - Fd,Lw,Py - P	4	0%
			3 - Se - G/M	45	5%
			5 - Hw,Cw - G/M	13	1%
			6 - Hw,Cw - P	5	0%
			7 - Pl,Pa,Pw - G/M	110	10%
			9 - Bl (ESSF) - All	52	5%
			Unspecified	299	28%
Group Shelterwood	169	1%			
			1 - Fd,Lw,Py - G/M	169	100%
Total Logging	**32278**	100%			

TABLE 4. Breakdown of past logging by analysis unit and silvicultural system for Arrow District licensees

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	3304	10%			
Fd,Lw,Py - G/M			Clearcut	1526	46%
			Group Seedtree	49	1%
			Uniform Seedtree	292	9%
			Group Selection	649	20%
			Single-tree Selection	95	3%
			Uniform Shelterwood	524	16%
			Group Shelterwood	169	5%
AU 2	224	1%			
Fd,Lw,Py - P			Clearcut	30	13%
			Group Seedtree	15	7%
			Group Selection	129	58%
			Single-tree Selection	46	21%
			Uniform Shelterwood	4	2%
AU 3	730	2%			
Se - G/M			Clearcut	554	76%
			Group Seedtree	19	3%
			Uniform Seedtree	10	1%
			Group Selection	102	14%
			Uniform Shelterwood	45	6%
AU 4	46	0%			
Se - P			Clearcut	16	35%
			Single-tree Selection	30	65%
AU 5	1027	3%			
Hw,Cw - G/M			Clearcut	843	82%
			Uniform Seedtree	25	2%
			Group Selection	127	12%
			Single-tree Selection	19	2%
			Uniform Shelterwood	13	1%
AU 6	46	0%			
Hw,Cw - P			Clearcut	31	67%
			Group Selection	10	22%
			Uniform Shelterwood	5	11%
AU 7	1580	5%			
Pl,Pa,Pw - G/M			Clearcut	480	30%
			Group Seedtree	28	2%
			Uniform Seedtree	363	23%
			Group Selection	534	34%
			Single-tree Selection	65	4%
			Uniform Shelterwood	110	7%
AU 9	375	1%			
Bl (ESSF) - All			Clearcut	219	58%
			Single-tree Selection	104	28%
			Uniform Shelterwood	52	14%
Unspecified AU	24943	77%			
			Clearcut	23652	95%
			Uniform Seedtree	400	2%
			Group Selection	379	2%
			Single-tree Selection	213	1%
			Uniform Shelterwood	299	1%
Total Logging	**32275**	100%			

There is very little use of partial-cutting systems by licensees in the district and therefore substantial opportunity for applying alternative systems to meet adjacency and other constraints. As with the Small Business Program, most of the partial cutting done by licensees occurs in AUs 1 (Fd,Lw,Py types on G/M sites) and 7 (pine types on G/M sites). Two other AUs (2 and 4) show predominantly partial cutting; however, only 1% of licensee logging in the district over the past 8 years took place in these AUs.

It is unlikely that the high proportion of unspecified AUs will affect the partial cutting breakdowns substantially, since 95% of the cutblocks with unspecified AUs were logged using clearcut systems (see Table 4). Unspecified AUs for partial-cutting systems ranged from 0 to 37% of area. Therefore, the information presented for partial-cutting systems in Tables 3 and 4 is based on sample sizes ranging from 63 to 100% (based on area) of known AUs for each system.

3.2 BOUNDARY DISTRICT

3.2.1 SBFEP

According to ISIS reports, Boundary District SBFEP logged more area over the past 8 years (1988 to the present) than any other Small Business Program in the NFR. Almost 11 000 ha were logged over this period, 68% using partial-cutting systems. Small Business Forester Dan Barron indicated that the time period in question (1988 to the present) includes a number of years in the late 1980s and early 1990s when mountain pine beetle outbreaks resulted in higher than normal cutting levels, and higher than current use of clearcut and seedtree systems. He feels that the numbers may be slightly skewed because of this.

Though a large portion of the SBFEP operating area is logged using partial-cutting systems, more than 70% of the area is logged using either clearcuts or low-volume retention systems. As can be seen in Table 5, much of the partial cutting done uses the seedtree system and most of the seedtree cutting is done in AU 9 (Pl leading). Much of this logging was/is for mountain pine beetle control and the proportions may be higher than current levels, given the time period in question. Barron also noted that some of the cuts labelled as seedtrees could more accurately be called shelterwoods since they often include areas of fairly heavy larch reserves.

Since neither clearcut nor seedtree systems meet the criteria required for mitigating adjacency constraints, it is likely that partial-cutting systems that retain greater volume (e.g.,, shelterwoods, single-tree selection, group selection) will be used increasingly in the future. These systems are often more appropriate for meeting non-timber constraints as well.

A large amount of single-tree selection logging is shown for AU 1 (Fd,Lw,Py leading - G/M sites) and some in AU 9 (Pl mix - G/M sites). Much of this area is actually pine selection cutting for beetle control, and is actually a form of shelterwood system rather than a true selection system. With the large amounts of clearcut and seedtree logging done as well in both these AUs, there may be good potential for increasing the use of higher volume retention systems.

TABLE 5. Breakdown of past logging by silvicultural system and analysis unit for Boundary District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit (lead spp. + site)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	3 528	32%			
			1 - Fd,Lw,Py - G/M	633	18%
			2 - Fd,Lw,Py - P	26	1%
			3 - Cw,Hw,Pw - G/M	8	0%
			5 - Sx, Bl - G/M	59	2%
			7 - Pl (pure) - G/M	524	15%
			9 - Pl (mixed) - G/M	1 037	29%
			11 - Pl (dense) - G/M	119	3%
			12 - Pl (dense) - P	2	0%
			Unspecified	1 120	32%
Uniform Seedtree	4 272	39%			
			1 - Fd,Lw,Py - G/M	584	14%
			2 - Fd,Lw,Py - P	25	1%
			5 - Sx, Bl - G/M	4	0%
			7 - Pl (pure) - G/M	456	11%
			9 - Pl (mixed) - G/M	2 221	52%
			10 - Pl (mixed) - P	40	1%
			11 - Pl (dense) - G/M	354	8%
			12 - Pl (dense) - P	97	2%
			Unspecified	501	12%
Group Selection	142	1%			
			9 - Pl (mixed) - G/M	22	15%
			Unspecified	120	85%
Single-tree Selection	2 827	26%			
			1 - Fd,Lw,Py - G/M	1 538	54%
			2 - Fd,Lw,Py - P	83	3%
			7 - Pl (pure) - G/M	57	2%
			9 - Pl (mixed) - G/M	332	12%
			10 - Pl (mixed) - P	52	2%
			11 - Pl (dense) - G/M	96	3%
			12 - Pl (dense) - P	56	2%
			Unspecified	613	22%
Uniform Shelterwood	64	1%			
			1 - Fd,Lw,Py - G/M	64	100%
Immature Cut	105	1%			
			Unspecified	105	100%
Total Logging	**10 938**	100%			

Past logging was also examined according to analysis units. Unfortunately, previous forest type information was not available for 22% of the logged area so these areas are listed in the Table 6 as "Unspecified." The bulk of the unspecified areas fall into the clearcut, uniform seedtree, and single-tree selection categories, and, for all three of these systems, AUs have been defined for at least 65% of the area. Therefore, the results shown in the table should be reasonably representative.

TABLE 6. Breakdown of past logging by analysis unit and silvicultural system for Boundary District SBFEP

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	2 819	26%			
Fd,Lw,Py - G/M			Clearcut	633	23%
			Uniform Seedtree	584	21%
			Single-tree Selection	1 538	54%
			Uniform Shelterwood	64	2%
AU 2	134	1%			
Fd,Lw,Py - P			Clearcut	26	19%
			Uniform Seedtree	25	19%
			Single-tree Selection	83	62%
AU 3	8	0%			
Cw,Hw,Pw - G/M			Clearcut	8	100%
AU 5	63	1%			
Sx,Bl - G/M			Clearcut	59	94%
			Uniform Seedtree	4	6%
AU 7	1 037	9%			
Pl (pure) - G/M			Clearcut	524	50%
			Uniform Seedtree	456	44%
			Single-tree Selection	57	6%
AU 9	3 612	33%			
Pl (mixed) - G/M			Clearcut	1 037	29%
			Uniform Seedtree	2 221	61%
			Single-tree Selection	332	9%
			Group Selection	22	1%
AU 10	92	1%			
Pl (mixed) - P			Uniform Seedtree	40	43%
			Single-tree Selection	52	57%
AU 11	569	5%			
Pl (dense) - G/M			Clearcut	119	21%
			Uniform Seedtree	354	62%
			Single-tree Selection	96	17%
AU 12	145	1%			
Pl (dense) - P			Clearcut	2	1%
			Uniform Seedtree	87	60%
			Single-tree Selection	56	39%
Unspecified	2 459	22%			
			Clearcut	1 120	46%
			Immature Thin	105	4%
			Uniform Seedtree	501	20%
			Single-tree Selection	613	25%
			Group Selection	120	5%
Total Logging	**10 937**	**100%**			

As shown in Table 6, AUs 2, 10, and 12 have substantial proportions of selection logging (probably shelterwood logging); however, only small areas of these units have been logged by the SBFEP over the past 8 years. The AUs in which most of the logging currently takes place (AUs 1 and 9) are logged using mostly clearcut or seedtree systems or a substantial portion of these systems. Again, this provides an opportunity for mitigating AAC reductions through the increased use of higher-volume retention systems.

Dan Barron, SBFEP Forester, noted that the occurence of commercial thinning in his district is substantially higher than the 105 ha shown in the ISIS database. He feels that somewhere in the neighbourhood of 500 hectares of commercial thinning has been done by the SBFEP over the past 8 years.

3.2.2 Licensees

According to the MLSIS database, licensees in the Boundary District logged a total of 23 795 hectares between 1988 and the present. The breakdown of logging by silvicultural system shows predominantly clearcut logging or seedtree logging, with very little use of higher-volume retention systems.

Clearcut and seedtree logging are used extensively by licensees throughout all analysis units (Tables 7 and 8). The only AUs with any substantial amount of an alternative system are AU 1 where 29% of the logging uses a single-tree selection system, and AU 2 where 47% of the logging is listed as group selection. These are likely pine removal cuts for mountain pine beetle control and are probably shelterwood cuts rather than true selection cuts.

A comparison of the FTAS and Form B silvicultural system listings showed about 25% discrepancy between listings, however 80% of these discrepancies were problems with classifying clearcuts with some reserves (e.g., is it a clearcut or is it a seedtree system?). The silvicultural systems used in the analysis are based on the Form B information.

Approximately 40 records (out of more than 1100) were present in the FTAS listings but not the Form B listings. Twenty of these show harvesting starting between 1988 and 1994 but there is not yet a final Form B for these blocks. This will not affect the start of the regeneration delay period since that is flagged by the harvest start date; however, it does suggest some minor problems with record keeping.

TABLE 7. Breakdown of past logging by silvicultural system and analysis unit for Boundary District Licensees

Silvicultural System	Area(ha) Logged	% Total Logged	Analysis Unit (lead spp. + site)	Area (ha) Logged	% of Silvi System
Clearcut	11 007	46%			
			1 - Fd,Lw,Py - G/M	195	2%
			2 - Fd,Lw,Py - P	1	0%
			3 - Cw,Hw,Pw - G/M	2	0%
			4 - Cw,Hw,Pw - P	34	0%
			5 - Sx, Bl - G/M	456	4%
			6 - Sx, Bl - P	85	1%
			7 - Pl (pure) - G/M	262	2%
			8 - Pl (pure) - P	15	0%
			9 - Pl (mixed) - G/M	1 828	17%
			10 - Pl (mixed) - P	161	1%
			11 - Pl (dense) - G/M	104	1%
			Unspecified	7 864	71%
Group Seedtree	103	0%			
			1 - Fd,Lw,Py - G/M	41	40%
			5 - Sx, Bl - G/M	33	32%
			7 - Pl (pure) - G/M	29	28%
Uniform Seedtree	10 999	46%			
			1 - Fd,Lw,Py - G/M	642	6%
			2 - Fd,Lw,Py - P	114	1%
			3 - Cw,Hw,Pw - G/M	25	0%
			5 - Sx, Bl - G/M	117	1%
			6 - Sx, Bl - P	14	0%
			7 - Pl (pure) - G/M	1 581	14%
			8 - Pl (pure) - P	249	2%
			9 - Pl (mixed) - G/M	3 180	29%
			10 - Pl (mixed) - P	226	2%
			11 - Pl (dense) - G/M	109	1%
			Unspecified	4 742	43%
Group Selection	1 031	4%			
			1 - Fd,Lw,Py - G/M	96	9%
			2 - Fd,Lw,Py - P	113	11%
			5 - Sx, Bl - G/M	15	1%
			9 - Pl (mixed) - G/M	93	9%
			10 - Pl (mixed) - P	5	0%
			Unspecified	709	69%
Single-tree Selection	577	2%			
			1 - Fd,Lw,Py - G/M	431	75%
			2 - Fd,Lw,Py - P	13	2%
			5 - Sx, Bl - G/M	2	0%
			6 - Sx, Bl - P	3	1%
			9 - Pl (mixed) - G/M	42	7%
			Unspecified	86	15%
Shelterwood (natural and strip)	78	0%			
			1 - Fd,Lw,Py - G/M	61	78%
			7 - Pl (pure) - G/M	12	15%
			10 - Pl (mixed) - P	5	6%
Total Logging	**23 795**	**100%**			

TABLE 8. Breakdown of past logging by analysis unit and silvicultural system for Boundary District Licensees

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	1 466	6%			
Fd,Lw,Py - G/M			Clearcut	195	13%
			Group Seedtree	41	3%
			Uniform Seedtree	642	44%
			Group Selection	96	7%
			Single-tree Selection	431	29%
			Shelterwood (strip + natural)	61	4%
AU 2	241	1%			
Fd,Lw,Py - P			Clearcut	1	0%
			Uniform Seedtree	114	47%
			Group Selection	113	47%
			Single-tree Selection	13	5%
AU 3	27	0%			
Cw,Hw,Pw - G/M			Clearcut	2	7%
			Uniform Seedtree	25	93%
AU 4					
Cw,Hw,Pw - P	34	0%	Clearcut	34	100%
AU 5	623	3%			
Sx,Bl - G/M			Clearcut	456	73%
			Group Seedtree	33	5%
			Uniform Seedtree	117	19%
			Group Selection	15	2%
			Single-tree Selection	2	0%
AU 6	102	0%			
Sx,Bl - P			Clearcut	85	83%
			Uniform Seedtree	14	14%
			Single-tree Selection	3	3%
AU 7	1 884	8%			
Pl (pure) - G/M			Clearcut	262	14%
			Group Seedtree	29	2%
			Uniform Seedtree	1 581	84%
			Shelterwood (strip + natural)	12	1%
AU 8	264	1%			
Pl (pure) - P			Clearcut	15	6%
			Uniform Seedtree	249	94%
AU 9	5 143	22%			
Pl (mixed) - G/M			Clearcut	1 828	35%
			Uniform Seedtree	3 180	62%
			Group Selection	93	2%
			Single-tree Selection	42	1%
AU 10	397	2%			
Pl (mixed) - P			Clearcut	161	40%
			Uniform Seedtree	226	57%
			Group Selection	5	1%
			Shelterwood (strip + natural)	5	1%
AU 11	213	1%			
Pl (dense) - G/M			Clearcut	104	49%
			Uniform Seedtree	109	51%
Unspecified	13 401	56%			
			Clearcut	7 864	59%
			Uniform Seedtree	4 742	35%
			Group Selection	709	5%
			Single-tree Selection	86	1%
Total Logging	**23 795**	100%			

3.3 CRANBROOK DISTRICT

3.3.1 SBFEP

Approximately 8700 ha were logged by the Cranbrook District Small Business Program between 1988 and the present. According to the ISIS database, the most commonly used silvicultural system was uniform seedtree, which was applied to 35% of the logged area.

About 600 ha of the logging were of forest types on low sites not normally considered as contributing to the AAC. A variety of systems were used on these areas, predominantly uniform seedtree and single-tree selection. It is not known whether these sites actually are low sites or whether there is a record-keeping error. If they are low sites, it would be interesting to track the success of these prescriptions over time.

Tables 9 and 10 show breakdowns of SBFEP logging in the district by silvicultural system and analysis unit. Although there are several partial-cutting systems used by the Cranbrook District Small Business Program, nearly 60% of the area is logged using either clearcut systems, or low-volume retention partial cutting such as seedtree systems. Therefore, there is still significant potential for manipulating wood flows, and mitigating wood supply impacts from non-timber values, through the increased use of silvicultural systems that retain greater proportions of volume on a site. This will help ensure optimum wood flow timing, and protection of non-timber values in the district.

As can be seen in Table 10, higher volume retention partial cutting is used in a number of AUs in the district (AUs 1, 3, 5, 10, 11, 12, and 13), some of which contribute substantially to the SBFEP cutting profile. In all cases, clearcut and seedtree systems are also used; however, numbers indicate great flexibility in terms of silvicultural systems choices for these units. The higher-volume retention systems used in the district include both selection and shelterwood cuts.

The ISIS results were checked with Steve Byford, Small Business Forester in Cranbrook District. Byford felt that the total area logged was reasonable; however, the breakdown by silvicultural system was somewhat inaccurate. According to Byford, most of the SBFEP logging over the past few years has been clearcut with reserves (approx. 40%), followed by modified shelterwood cuts (approx. 20 to 25%) and seedtree cuts (approx. 20 to 25%), with the remainder being group shelterwoods (5%) and a small amount of selection logging (<5%). The modified shelterwoods he prescribes retain the overstory permanently as a reserve, retain understory stems as much as possible, and promote natural regeneration, although they are managed on an even-aged basis.

TABLE 9. Breakdown of past logging by silvicultural system and analysis unit for Cranbrook District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1 752	20%			
			1 - Pl (pure) - G/M	267	15%
			3 - Pl (lead.) - G/M	295	17%
			4 - Pl (lead.) - P	82	5%
			5 - Pl (age cl. 3) - G/M/P	234	13%
			6-SB types,Pw,Pa or FS-G/M	75	4%
			8a-CH types, FC,FH-G/M/P	45	3%
			10 - FPy, Py - G/M	13	1%
			11 - FPy, Py - P	58	3%
			13 - FL types, FPl - G/M	270	15%
			14 - FL types, FPl - P	35	2%
			x - Pl - Low	36	2%
			Unspecified	342	20%
Group Seedtree	194	2%			
			3 - Pl (lead.) - G/M	52	27%
			11 - FPy, Py - P	33	17%
			14 - FL types, FPl - P	33	17%
			Unspecified	76	39%
Uniform Seedtree	3 088	35%			
			1 - Pl (pure) - G/M	182	6%
			2 - Pl (pure) - P	78	3%
			3 - Pl (lead.) - G/M	527	17%
			4 - Pl (lead.) - P	146	5%
			5 - Pl (age cl. 3) - G/M/P	385	12%
			10 - FPy, Py - G/M	212	7%
			11 - FPy, Py - P	261	8%
			13 - FL types, FPl - G/M	476	15%
			14 - FL types, FPl - P	257	8%
			x - Pl - Low	221	7%
			Unspecified	343	11%
Group Selection	84	1%			
			3 - Pl (lead.) - G/M	18	21%
			Unspecified	66	79%
Single-tree Selection	2 334	27%			
			1 - Pl (pure) - G/M	187	8%
			2 - Pl (pure) - P	20	1%
			3 - Pl (lead.) - G/M	337	14%
			4 - Pl (lead.) - P	40	2%
			5 - Pl (age cl. 3) - G/M/P	287	12%
			10 - FPy, Py - G/M	528	23%
			11 - FPy, Py - P	77	3%
			13 - FL types, FPl - G/M	364	16%
			x - Pl - Low	287	12%
			Unspecified	207	9%
Group Shelterwood	178	2%			
			12 - FPy,Py,F,FPl - L	28	16%
			Unspecified	150	84%
Uniform Shelterwood	1 103	13%			
			1 - Pl (pure) - G/M	18	2%
			2 - Pl (pure) - P	6	1%
			3 - Pl (lead.) - G/M	94	9%
			5 - Pl (age cl. 3) - G/M/P	98	9%
			10 - FPy, Py - G/M	41	4%
			11 - FPy, Py - P	113	10%
			12 - FPy,Py,F,FPl - L	71	6%
			13 - FL types, FPl - G/M	221	20%
			14 - FL types, FPl - P	86	8%
			x - Pl - Low	57	5%
			Unspecified	298	27%
Total Logging	**8 733**	**100%**			

TABLE 10. Breakdown of past logging by analysis unit and silvicultural system for Cranbrook District SBFEP

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	654	7%			
Pl (pure) - G/M			Clearcut	267	41%
			Uniform Seedtree	182	28%
			Single-tree Selection	187	28%
			Uniform Shelterwood	18	3%
AU 2	104	1%			
Pl (pure) - P			Uniform Seedtree	78	75%
			Single-tree Selection	20	19%
			Uniform Shelterwood	6	6%
AU 3	1 323	15%			
Pl (lead.) - G/M			Clearcut	295	22%
			Group Seedtree	52	4%
			Uniform Seedtree	527	40%
			Group Selection	18	1%
			Single-tree Selection	337	25%
			Uniform Shelterwood	94	7%
AU 4	268	3%			
Pl (lead.) - P			Clearcut	82	31%
			Uniform Seedtree	146	54%
			Single-tree Selection	40	15%
AU 5	1 005	12%			
Pl (age cl. 3) - G/M/P			Clearcut	234	23%
			Uniform Seedtree	385	38%
			Single-tree Selection	287	29%
			Uniform Shelterwood	98	10%
AU 6 - SB types, Pw,Pa or FS-G/M	75	1%	Clearcut	75	100%
AU 8a - CH types, FC,FH-G/M/P	45	1%	Clearcut	45	100%
AU 10	794	9%			
FPy,Py - G/M			Clearcut	13	2%
			Uniform Seedtree	212	27%
			Single-tree Selection	528	66%
			Uniform Shelterwood	41	5%
AU 11	542	6%			
FPy,Py - P			Clearcut	58	11%
			Group Seedtree	33	6%
			Uniform Seedtree	261	48%
			Single-tree Selection	77	14%
			Uniform Shelterwood	113	21%
AU 12	99	1%			
FPy,Py,F,FPl - L			Group Shelterwood	28	28%
			Uniform Shelterwood	71	72%
AU 13	1 331	15%			
FL types,FPl-G/M			Clearcut	270	20%
			Uniform Seedtree	476	36%
			Single-tree Selection	364	27%
			Uniform Shelterwood	221	17%
AU 14	411	5%			
FL types,FPl - P			Clearcut	35	9%
			Group Seedtree	33	8%
			Uniform Seedtree	257	62%
			Uniform Shelterwood	86	21%

TABLE 10 continued.

Unspecified AU	1 482	17%		
			Clearcut	342	23%
			Group Seedtree	76	5%
			Uniform Seedtree	343	23%
			Group Selection	66	4%
			Single-tree Selection	207	14%
			Group Shelterwood	150	10%
			Uniform Shelterwood	298	20%
Other (x)	601	7%		
Pl - L			Clearcut	36	6%
			Uniform Seedtree	221	37%
			Single-tree Selection	287	48%
			Uniform Shelterwood	57	9%
Total Logging	**8 734**	100%		

3.3.2 Licensees

Licensees in the Cranbrook Forest District logged close to 25 000 hectares over the past 8 years (1988 to the present), most of this using either clearcut or seedtree systems (see Tables 11 and 12).

As for SBFEP logging, many AUs have a variety of silvicultural systems applied, which suggests great flexibility when choosing systems appropriate for a specific forest type and circumstance. Unlike Small Business Program logging, the MLSIS database shows very little use of shelterwood systems by district licensees. It is very likely that most of the openings listed as selection logging could more accurately be described as shelterwoods. These blocks are often prescribed for pine removal using even-aged management regimes.

A comparison of the silvicultural systems listings in FTAS and Form B indicated more than 30% discrepancy between the two record-keeping systems. Many of the problems were between clearcut and seedtree labels because of confusion as to whether or not reserved trees should be considered seedtrees. Form B labels were used except where manual checks of PHSPs and SPs showed a different label to be more appropriate.

PHSPs and SPs were reviewed for about 3% of licensee cutblocks in the district to see how well the Form B listings reflected the prescriptions. Results of this review were inconclusive, however, due either to poorly described objectives, management regimes, and stand types in many of the prescriptions, or to very complex prescriptions that are difficult to describe with one label. At least 50% of the prescriptions matched the Form B listings; however, remaining questionable listings were hard to verify as appropriately classified or not.

As with other districts, a small number of blocks were found in only one of the two databases (FTAS or Form B) and therefore may not be tracked properly over time.

TABLE 11. Breakdown of past logging by silvicultural system and analysis unit for Cranbrook District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	11 884	48%			
			1 - Pl (pure) - G/M	1 109	9%
			2 - Pl (pure) - P	207	2%
			3 - Pl (lead.) - G/M	2 753	23%
			4 - Pl (lead.) - P	460	4%
			6-SB types,Pw,Pa or FS-G/M	422	4%
			7-SB types,Pw,Pa or FS-P	241	2%
			8a-CH types, FC,FH-G/M/P	83	1%
			10 - FPy, Py - G/M	132	1%
			11 - FPy, Py - P	146	1%
			13 - FL types, FPl - G/M	564	5%
			14 - FL types, FPl - P	215	2%
			15-High Elev (>1800m)-G/M/P	88	1%
			Unspecified	5 465	46%
Uniform Seedtree	7 059	28%			
			1 - Pl (pure) - G/M	1 026	15%
			2 - Pl (pure) - P	71	1%
			3 - Pl (lead.) - G/M	2 578	37%
			4 - Pl (lead.) - P	449	6%
			6-SB types,Pw,Pa or FS-G/M	93	1%
			10 - FPy, Py - G/M	18	0%
			11 - FPy, Py - P	71	1%
			13 - FL types, FPl - G/M	942	13%
			14 - FL types, FPl - P	147	2%
			Unspecified	1 663	24%
Group Selection	4 956	20%			
			1 - Pl (pure) - G/M	189	4%
			2 - Pl (pure) - P	158	3%
			3 - Pl (lead.) - G/M	909	18%
			4 - Pl (lead.) - P	388	8%
			6-SB types,Pw,Pa or FS-G/M	40	1%
			10 - FPy, Py - G/M	18	0%
			11 - FPy, Py - P	259	5%
			13 - FL types, FPl - G/M	808	16%
			14 - FL types, FPl - P	280	6%
			Unspecified	1 907	38%
Single-tree Selection	273	1%			
			3 - Pl (lead.) - G/M	86	32%
			4 - Pl (lead.) - P	18	7%
			6-SB types,Pw,Pa or FS-G/M	9	3%
			11 - FPy, Py - P	59	22%
			13 - FL types, FPl - G/M	42	15%
			14 - FL types, FPl - P	33	12%
			Unspecified	26	10%
Group Shelterwood	84	0%			
			13 - FL types, FPl - G/M	84	100%
Uniform Shelterwood	568	2%			
			3 - Pl (lead.) - G/M	289	51%
			13 - FL types, FPl - G/M	163	29%
			14 - FL types, FPl - P	53	9%
			Unspecified	63	11%
Total Logging	**24824**	**100%**			

TABLE 12. Breakdown of past logging by analysis unit and silvicultural system for Cranbrook District licensees

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1 Pl (pure) - G/M	2 324	9%			
			Clearcut	1 109	48%
			Uniform Seedtree	1 026	44%
			Group Selection	189	8%
AU 2 Pl (pure) - P	436	2%			
			Clearcut	207	47%
			Uniform Seedtree	71	16%
			Group Selection	158	36%
AU 3 Pl (lead.) - G/M	6 615	27%			
			Clearcut	2 753	42%
			Uniform Seedtree	2 578	39%
			Group Selection	909	14%
			Single-tree Selection	86	1%
			Uniform Shelterwood	289	4%
AU 4 Pl (lead.) - P	1 315	5%			
			Clearcut	460	35%
			Uniform Seedtree	449	34%
			Group Selection	388	30%
			Single-tree Selection	18	1%
AU 6 - SB types, Pw,Pa or FS-G/M	564	2%			
			Clearcut	422	75%
			Uniform Seedtree	93	16%
			Group Selection	40	7%
			Uniform Shelterwood	9	2%
AU 7 - SB types, Pw,Pa or FS - P	241	1%			
			Clearcut	241	100%
AU 8a - CH types, FC,FH - G/M/P	83	0%			
			Clearcut	83	100%
AU 10 FPy,Py - G/M	168	1%			
			Clearcut	132	78%
			Uniform Seedtree	18	11%
			Group Selection	18	11%
AU 11 FPy,Py - P	535	2%			
			Clearcut	146	27%
			Uniform Seedtree	71	13%
			Group Selection	259	48%
			Single-tree Selection	59	11%
AU 13 FL types,FPl-G/M	2 603	10%			
			Clearcut	564	22%
			Uniform Seedtree	942	36%
			Group Selection	808	31%
			Single-tree Selection	42	2%
			Group Shelterwood	84	3%
			Uniform Shelterwood	163	6%
AU 14 FL types,FPl - P	728	3%			
			Clearcut	215	30%
			Uniform Seedtree	147	20%
			Group Selection	280	38%
			Single-tree Selection	33	5%
			Uniform Shelterwood	53	7%
AU 15 - High Elev. (>1800m) - G/M/P	88	0%			
			Clearcut	88	100%
Unspecified	9 124	37%			
			Clearcut	5 465	60%
			Uniform Seedtree	1 663	18%
			Group Selection	1 907	21%
			Single-tree Selection	26	0%
			Uniform Shelterwood	63	1%
Total Logging	24 824	100%			

3.4 GOLDEN DISTRICT

3.4.1 SBFEP

ISIS reports for the Golden District for the period from 1988 to the present indicate a total of approximately 1900 ha logged by the SBFEP. On merging the three database reports, only 1650 ha were represented on all three reports and show up in the subsequent analysis (see Appendix 3). Given the significant loss of information using the merged reports, this discussion is based on the full data set where possible.

Analysis units in the Golden District are based on fairly generalized forest cover groups (only four categories) linked with geographic resource units. The past practices analysis was done by both silvicultural system and by forest cover group. Analysis showed that only a minor amount (13% – using complete database) of partial cutting has been done by the Golden District SBFEP since 1988.

The comparison of logging by forest cover groups required use of the data from the merged reports only (total area logged = 1646 ha) because forest cover and biogeoclimatic information was not available for the unmatched records. For all four of the forest cover groups characterized for the district, clearcut logging was by far the predominant silvicultural system used. Unfortunately, only a third of the single-tree selection logging is accounted for due to merging reductions.

TABLE 13. Breakdown of past logging by silvicultural system and forest cover unit for Golden District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Forest Cover Unit (lead spp.+site)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1 489	90%			
			1-Cw,Hw,Sx,Bl-G/M	562	38%
			2-Cw,Hw,Sx,Bl-P	139	9%
			3-Fd,Pine,Lw-G/M	545	37%
			4-Fd,Pine,Lw-P	22	1%
			Unspecified	221	15%
Uniform Seedtree	57	3%			
			3-Fd,Pine,Lw-G/M	57	100%
Single-tree Selection	100	6%			
			1-Cw,Hw,Sx,Bl-G/M	10	10%
			2-Cw,Hw,Sx,Bl-P	27	27%
			3-Fd,Pine,Lw-G/M	63	63%
Total Logging	**1 646**	100%			

TABLE 14. Breakdown of past logging by forest cover unit and silvicultural system for Golden District SBFEP

Forest Cover Unit (FC)	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
FC 1 Cw,Hw,Sx,Bl - G/M	572	35%			
			Clearcut	562	98%
			Single-tree Selection	10	2%
FC 2 Cw,Hw,Sx,Bl - P	166	10%			
			Clearcut	139	84%
			Single-tree Selection	27	16%
FC 3 Fd,Pine,Lw - G/M	665	40%			
			Clearcut	545	82%
			Uniform Seedtree	57	9%
			Single-tree Selection	63	9%
FC 4 Fd,Pine,Lw - P	22	1%			
			Clearcut	22	100%
Unspecified FC	221	13%			
			Clearcut	221	100%
Total Logging	**1 646**	100%			

As shown in table 14, 40% of the logging done by the district SBFEP is in the Fd,Pine,Lw forest cover type. This is a type in which other districts tend to practice a substantial amount of partial cutting. Though some uniform seedtree and selection logging is done in this type in Golden District, most of the area is logged using clearcut systems.

Conversations with Bob Richkum (SBFEP) indicate that the amount of partial cutting done in the district is already beginning to increase because of the Forest Practices Code and various land base constraints[1]. However, Richkum sees much of the activity moving towards group selection blocks, rather than to the full range of partial-cutting alternatives. He feels that root disease concerns deter the use of uniform shelterwood and single-tree selection type prescriptions.

3.4.2 Licensees

Licensees in the Golden Forest District logged a total of 9786 ha over the past 8 years. As with SBFEP logging in the district, almost all the licensee logging over that time has been clearcut logging (or clearcut with reserves). As shown in Table 15, 95% of the area logged by licensees uses clearcut silvicultural systems (compared to 90% for the SBFEP).

[1]Gosal, K.K. 1995. Partial cutting in the Nelson Forest Region - Logging contractor interview notes. Unpublished report. On file with Forest Sciences Section, Nelson Forest Region, 518 Lake St., Nelson, B.C.

TABLE 15. Breakdown of past logging by silvicultural system and forest cover unit for Golden District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Forest Cover Unit (lead spp.+site)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	9 340	95%			
			1-Cw,Hw,Sx,Bl-G/M	314	3%
			2-Cw,Hw,Sx,Bl-P	95	1%
			3-Fd,Pine,Lw-G/M	114	1%
			Unspecified	8 817	94%
Uniform Seedtree	199	2%			
			3-Fd,Pine,Lw-G/M	199	100%
Group Selection	173	2%			
			1-Cw,Hw,Sx,Bl-G/M	41	24%
			2-Cw,Hw,Sx,Bl-P	79	46%
			3-Fd,Pine,Lw-G/M	53	31%
Uniform Shelterwood	23	0%			
			3-Fd,Pine,Lw-G/M	23	100%
Unspecified	51	1%			
			2-Cw,Hw,Sx,Bl-P	20	39%
			Unspecified	31	61%
Total Logging	**9 786**	100%			

TABLE 16. Breakdown of past logging by forest cover unit and silvicultural system for Golden District licensees

Forest Cover Unit (FC)	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
FC 1	355	4%			
Cw,Hw,Sx,Bl - G/M			Clearcut	314	88%
			Group Selection	41	12%
FC 2	194	2%			
Cw,Hw,Sx,Bl - P			Clearcut	95	49%
			Group Selection	79	41%
			Unspecified	20	10%
FC 3	389	4%			
Fd,Pine,Lw - G/M			Clearcut	114	29%
			Uniform Seedtree	199	51%
			Group Selection	53	14%
			Uniform Shelterwood	23	6%
FC 4	0	0%			
Fd,Pine,Lw - P				0	0
Unspecified FC	8 848	90%			
			Clearcut	8 817	100%
			Unspecified	31	0%
Total Logging	**9 786**	100%			

A comparison of FTAS and Form B silvicultural systems listings for Golden licensee blocks showed about 25% discrepancies between the two tracking systems. All blocks listed as partial-cutting systems in the Form B listing were manually checked by district staff against opening records and about 25% of these listings were found to be incorrect (relative to the prescription). Silvicultural systems listings were changed to reflect the information provided by the district from the prescription, rather than the Form B information. Therefore the information provided in Tables 15 and 16 should be quite accurate.

3.5 INVERMERE DISTRICT

3.5.1 SBFEP

ISIS database reports for the Invermere Forest District SBFEP show a variety of silvicultural systems used over the past 8 years (1988 to the present). A total area of 4550 ha was logged during the period, 65% using either clearcut or seedtree systems but the remainder using a variety of higher-volume retention partial-cutting systems (see Table 17).

A breakdown of logging by analysis unit and silvicultural system (Table 18) shows a number of units in which substantial amounts of partial cutting are done, using a variety of systems including both shelterwoods and selection cuts. This suggests great flexibility in terms of silvicultural systems options throughout many of the forest types and this should allow for greater use of higher-volume retention systems where necessary in the future.

Unfortunately, the previous type information fields for Invermere District are often incomplete. Analysis units could not be assigned to more than 30% of the logged area (1460 ha). Of this unspecified area, 70% of the logging was clearcut logging, and this probably represents a wide range of AUs.

A breakdown of silvicultural systems according to biogeoclimatic subzone and variant is provided in Appendix 2. Most of the biogeoclimatic subzones and variants in which partial cutting is being prescribed in Invermere District are listed as high hazard areas for *Armillaria* root disease – ICHmk1, IDFdm2, and MSdk (see Root Disease Management Guidebook for listing of hazard rating by subzone). Though root removal is being done on some sites, by far the majority of areas are conventionally logged. Licencees and Ministry of Forests personnel in the district do not seem to have the same reluctance to the use of partial cutting in potential root disease areas that is seen in some districts.

Although there is a substantial amount of partial cutting done by the district SBFEP, there is likely still great potential to manipulate wood flows, and mitigate wood supply impacts from non-timber values, through the increased use of silvicultural systems that retain

greater proportions of volume on a site. In order to avoid adjacency concerns, a prescription must allow for at least 40% of existing basal area to be left on site. Twenty-seven percent of the Small Business Program logging over the past 8 years in Invermere District used seedtree systems where less than 40% of stand volume would have been retained. The combined area of seedtree and clearcut logging over the past 8 years was more than 60% of the total area logged. This leaves substantial room for manipulating silvicultural systems choices to ensure optimum wood flow timing and protection of non-timber values in the district.

TABLE 17. Breakdown of past logging by silvicultural system and analysis unit for Invermere District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit (lead spp. + site)*	*Area (ha) Logged*	*% of Silvi. System*
Clearcut	1 676	37%			
			2 - Fd,Lw,Py - M	114	7%
			3 - Fd,Lw,Py - P	128	8%
			4 - Fd,Lw,Py - L	93	6%
			6 - Sx, Bl - M	24	1%
			9 - Pl,Pw - G	67	4%
			10 - Pl,Pw - M	191	11%
			11 - Pl,Pw - P	22	1%
			Unspecified	1 037	62%
Uniform Seedtree	1 243	27%			
			1 - Fd,Lw,Py - G	53	4%
			2 - Fd,Lw,Py - M	221	18%
			3 - Fd,Lw,Py - P	53	4%
			6 - Sx, Bl - M	79	6%
			7 - Sx, Bl - P	30	2%
			9 - Pl,Pw - G	71	6%
			10 - Pl,Pw - M	403	32%
			11 - Pl,Pw - P	92	7%
			Unspecified	241	19%
Group Selection	39	1%			
			Unspecified	39	100%
Single-tree Selection	765	17%			
			2 - Fd,Lw,Py - M	209	27%
			3 - Fd,Lw,Py - P	97	13%
			4 - Fd,Lw,Py - L	213	28%
			10 - Pl,Pw - M	168	22%
			Unspecified	78	10%
Group Shelterwood (includes strip shelter)	65	1%			
			2 - Fd,Lw,Py - M	30	46%
			6 - Sx, Bl - M	35	54%
Uniform Shelterwood (includes irregular shelterwoods)	762	17%			
			1 - Fd,Lw,Py - G	32	4%
			2 - Fd,Lw,Py - M	374	49%
			3 - Fd,Lw,Py - P	201	26%
			9 - Pl,Pw - G	25	3%
			10 - Pl,Pw - M	65	9%
			Unspecified	65	9%
Total Logging	**4 550**	100%			

TABLE 18. Breakdown of past logging by analysis unit and silvicultural system for Invermere District SBFEP

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	85	2%			
Fd,Lw,Py - G			Uniform Seedtree	53	62%
			Uniform Shelterwood	32	38%
AU 2	948	21%			
Fd,Lw,Py - M			Clearcut	114	12%
			Uniform Seedtree	221	23%
			Single-tree Selection	209	22%
			Group Shelterwood	30	3%
			Uniform Shelterwood	374	39%
AU 3	479	10%			
Fd,Lw,Py - P			Clearcut	128	27%
			Uniform Seedtree	53	11%
			Single-tree Selection	97	20%
			Uniform Shelterwood	201	42%
AU 4	307	7%			
Fd,Lw,Py - L			Clearcut	94	31%
			Uniform Seedtree	213	69%
AU 6	138	3%			
Sx,Bl - M			Clearcut	24	18%
			Uniform Seedtree	79	57%
			Strip Shelterwood	35	25%
AU 7	30	1%			
Sx,Bl - P			Uniform Seedtree	30	100%
AU 9	163	4%			
Pl,Pw - G			Clearcut	67	41%
			Uniform Seedtree	71	44%
			Uniform Shelterwood	25	15%
AU 10	827	18%			
Pl,Pw - M			Clearcut	191	23%
			Uniform Seedtree	403	49%
			Single-tree Selection	168	20%
			Uniform Shelterwood	65	8%
AU 11	114	3%			
Pl,Pw - P			Clearcut	22	19%
			Uniform Seedtree	92	81%
Unspecified AU	1 460	32%			
			Clearcut	1 037	71%
			Uniform Seedtree	241	17%
			Group Selection	39	3%
			Single-tree Selection	78	5%
			Uniform Shelterwood	65	4%
Total Logging	**4 551**	100%			

3.5.2 Licensees

Licensees in the Invermere Forest District cut a total of 21 400 ha over the past 8 years. Almost 80% of this area was logged using either clearcut or seedtree silvicultural systems (see Table 19).

TABLE 19. Breakdown of past logging by silvicultural system and analysis unit for Invermere District licensees

Silvicultural System	Area(ha) Logged	% Total Logged	Analysis Unit	Area (ha) Logged	% of Silvi System
Clearcut	12 685	59%			
			1 - Fd,Lw,Py - G	125	1%
			2 - Fd,Lw,Py - M	706	6%
			3 - Fd,Lw,Py - P	28	0%
			5 - Sx, Bl - G	330	3%
			6 - Sx, Bl - M	522	4%
			7 - Sx,Bl - P	80	1%
			8 - Cw,Hw - All	16	0%
			9 - Pl,Pw - G	697	5%
			10 - Pl,Pw - M	2 545	20%
			11 - Pl,Pw - P	335	3%
			Unspecified	7 301	58%
Group Seedtree	114	1%			
			1 - Fd,Lw,Py - G	11	10%
			2 - Fd,Lw,Py - M	26	23%
			3 - Fd,Lw,Py - P	32	28%
			10 - Pl,Pw - M	3	3%
			Unspecified	42	37%
Uniform Seedtree	4 080	19%			
			1 - Fd,Lw,Py - G	65	2%
			2 - Fd,Lw,Py - M	620	15%
			3 - Fd,Lw,Py - P	34	1%
			5 - Sx, Bl - G	90	2%
			6 - Sx, Bl - M	83	2%
			9 - Pl,Pw - G	348	9%
			10 - Pl,Pw - M	1542	38%
			11 - Pl,Pw - P	75	2%
			Unspecified	1223	30%
Group Selection	709	3%			
			2 - Fd,Lw,Py - M	290	41%
			3 - Fd,Lw,Py - P	105	15%
			6 - Sx, Bl - M	16	2%
			9 - Pl,Pw - G	95	13%
			10 - Pl,Pw - M	11	2%
			Unspecified	192	27%
Single-tree Selection	1 532	7%			
			1 - Fd,Lw,Py - G	5	0%
			2 - Fd,Lw,Py - M	499	33%
			3 - Fd,Lw,Py - P	218	14%
			9 - Pl,Pw - G	38	2%
			10 - Pl,Pw - M	32	2%
			Unspecified	740	48%
Group Shelterwood	219	1%			
			2 - Fd,Lw,Py - M	22	10%
			3 - Fd,Lw,Py - P	109	50%
			9 - Pl,Pw - G	4	2%
			10 - Pl,Pw - M	83	38%
Uniform Shelterwood (includes natural and irregular shelterwoods)	2 062	10%			
			1 - Fd,Lw,Py - G	81	4%
			2 - Fd,Lw,Py - M	683	33%
			3 - Fd,Lw,Py - P	75	4%
			9 - Pl,Pw - G	232	11%
			10 - Pl,Pw - M	529	26%
			11 - Pl,Pw - P	66	3%
			12 - Decid - All	3	0%
			Unspecified	392	19%
Total Logging	21 401	100%			

TABLE 20. Breakdown of past logging by analysis unit and silvicultural system for Invermere District licensees

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	287	1%			
Fd,Lw,Py - G			Clearcut	125	44%
			Group Seedtree	11	4%
			Uniform Seedtree	65	23%
			Single-tree Selection	5	2%
			Uniform Shelterwood	81	28%
AU 2	2 846	13%			
Fd,Lw,Py - M			Clearcut	706	25%
			Group Seedtree	26	1%
			Uniform Seedtree	620	22%
			Group Selection	290	10%
			Single-tree Selection	499	18%
			Group Shelterwood	22	1%
			Uniform Shelterwood	683	24%
AU 3	601	3%			
Fd,Lw,Py - P			Clearcut	28	5%
			Group Seedtree	32	5%
			Uniform Seedtree	34	6%
			Group Selection	105	17%
			Single-tree Selection	218	36%
			Group Shelterwood	109	18%
			Uniform Shelterwood	75	12%
AU 5	420	2%			
Sx,Bl - G			Clearcut	330	79%
			Uniform Seedtree	90	21%
AU 6	621	3%			
Sx,Bl - M			Clearcut	522	84%
			Uniform Seedtree	83	13%
			Group Selection	16	3%
AU 7	80	0%			
Sx,Bl - P			Clearcut	80	100%
AU 8	16	0%			
Cw,Hw - All			Clearcut	16	100%
AU 9	1 414	7%			
Pl,Pw - G			Clearcut	697	49%
			Uniform Seedtree	348	25%
			Group Selection	95	7%
			Single-tree Selection	38	3%
			Group Shelterwood	4	0%
			Uniform Shelterwood	232	16%
AU 10	4 745	22%			
Pl,Pw - M			Clearcut	2 545	53%
			Group Seedtree	3	0%
			Uniform Seedtree	1 542	32%
			Group Selection	11	0%
			Single-tree Selection	32	1%
			Group Shelterwood	83	2%
			Uniform Shelterwood	529	11%
AU 11	476	2%			
Pl,Pw - P			Clearcut	335	70%
			Uniform Seedtree	75	16%
			Uniform Shelterwood	66	14%
AU 12	3	0%			
Decid. - All			Uniform Shelterwood	3	100%
Unspecified AU	9 890	46%			
			Clearcut	7 301	74%
			Group Seedtree	42	0%
			Uniform Seedtree	1 223	12%
			Group Selection	192	2%
			Single-tree Selection	740	8%
			Uniform Shelterwood	392	4%
Total Logging	**21 399**	**100%**			

As shown in Table 20, a variety of silvicultural systems are used by licensees in many of the AUs; however, only AUs 2 and 3 use predominantly higher-volume retention systems. Several AUs are logged entirely with clearcut or seedtree systems. There appears to be good opportunity for increasing the proportions of higher-volume retention systems used by licensees in the district.

A check of silvicultural systems listings in FTAS and Form B showed fewer than 25% discrepancies, many of these between clearcut and seedtree classifications. A manual check of a very small sample (2%) of prescriptions showed that the Form B listings used in this analysis were correct for about 90% of the blocks.

3.6 KOOTENAY LAKE DISTRICT

3.6.1 SBFEP

Kootenay Lake District SBFEP had the third lowest level of partial cutting in the NFR (between 1988 and the present), after Revelstoke and Golden. The ISIS reports for the district show a total of 3800 hectares logged by the SBFEP since January 1988, 81% of

TABLE 21. Breakdown of past logging by silvicultural system and analysis unit for Kootenay Lake District SBFEP. Note: Analysis units used are based on Regional Protocol (see Appendix 1).

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit (Regional Class.)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	3 118	81%			
			1 - Fd,Lw,Py - G/M	576	18%
			3 - Hw,Cw - G/M	610	20%
			4 - Hw,Cw - P	177	6%
			5 - Sx,Bl - G/M	145	5%
			6 - Sx,Bl - P	68	2%
			7 - Pl,(PwPa) - G/M	841	27%
			8 - Pl,(PwPa) - P	49	2%
			Unspecified	652	21%
Group Seedtree	28	1%			
			1 - Fd,Lw,Py - G/M	28	100%
Uniform Seedtree	376	10%			
			1 - Fd,Lw,Py - G/M	72	19%
			3 - Hw,Cw - G/M	4	1%
			7 - Pl,(PwPa) - G/M	210	56%
			Unspecified	90	24%
Single-tree Selection	306	8%			
			1 - Fd,Lw,Py - G/M	34	11%
			2 - Fd,Lw,Py - P	245	80%
			5 - Sx,Bl - G/M	10	3%
			7 - Pl,(PwPa) - G/M	13	4%
			Unspecified	4	1%
Uniform Shelterwood	7	0%			
			1 - Fd,Lw,Py - G/M	7	100%
Total Logging	**3 835**	100%			

this harvested using clearcut silvicultural systems. An additional 10% was logged using uniform seedtree systems. Reasons cited by the past SBFEP forester, Jim Schafthuizen, include root disease concerns and a high incidence of decadent old forest types that may not be well suited to partial cutting.

An analysis of logging by district-specific analysis units was not possible because Kootenay Lake District uses AUs that are based on a combination of management zone designations (visuals, winter range, etc.) and forest cover. Instead, a breakdown of past logging by silvicultural system and regional analysis units was done and is presented in the following table.

TABLE 22. Breakdown of past logging by analysis unit and silvicultural system for Kootenay Lake District SBFEP Note: Analysis units used are based on Regional Protocol.

Analysis Unit	*Area (ha) Logged*	*% Total Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1 Fd,Lw,Py - G/M	717	19%			
			Clearcut	576	80%
			Group Seedtree	28	4%
			Uniform Seedtree	72	10%
			Single-tree Selection	34	5%
			Uniform Shelterwood	7	1%
AU 2 Fd,Lw,Py - P	245	6%			
			Single-tree Selection	245	100%
AU 3 Hw,Cw - G/M	614	16%			
			Clearcut	610	99%
			Uniform Seedtree	4	1%
AU 4 Hw,Cw - P	177	5%			
			Clearcut	177	100%
AU 5 Sx,Bl - G/M	155	4%			
			Clearcut	145	94%
			Single-tree Selection	10	6%
AU 6 Sx,Bl - P	68	2%			
			Clearcut	68	100%
AU 7 Pl,(PwPa) - G/M	1 064	28%			
			Clearcut	841	79%
			Uniform Seedtree	210	20%
			Single-tree Selection	13	1%
AU 8 Pl,(PwPa) - P	49	1%			
			Clearcut	49	100%
Unspecified AU	746	19%			
			Clearcut	652	87%
			Uniform Seedtree	90	12%
			Single-tree Selection	4	1%
Total Logging	**3 835**	**100%**			

Interestingly, the only AU that shows substantial use of high-volume retention silvicultural system use is AU 2 (Fd,Lw,Py types on poor sites) where 100% of the logging over the past 8 years was single-tree selection. In AU 1, however, which is the same forest types but on good or medium sites, 80% of the logging uses a clearcut system. There should be good opportunity for using shelterwood or selection systems in AU 1.

3.6.2 Licensees

Licensees in the Kootenay Lake Forest District logged just over 10 300 ha over the eight year period between 1988 and the present. As with SBFEP logging in the district, more than 80% of the licensee logging used a clearcut silvicultural system and an additional 10% used seedtree systems (see Table 23).

Few of the analysis units found in the district showed any substantial proportion of high-volume retention silvicultural system use, with the notable exception of AU 2 (as with SBFEP logging). This analysis unit was logged entirely using either shelterwood or selection systems. Unfortunately only 44 ha of this unit were logged by licensees over the past 8 years, so it contributes very little to overall logging figures (approx. 0% of the cut). AU 1, which represents the same forest types but on good or medium sites (rather than poor sites), was logged using 66% clearcut systems and 19% seedtree systems. Presumably shelterwoods and selection cuts could be applied more frequently in this analysis unit and likely in a number of the other units found in the district also.

A comparison of silvicultural systems listings between FTAS records and Form B records showed only a 10% discrepancy in listings. However, most of the discrepancies were with the partially cut blocks (i.e., clearcuts were listed as clearcuts in both systems but partial cuts were often listed differently between systems). More than 40% of the blocks listed as partial cuts in Form B had mismatched silvicultural systems listings when compared to FTAS. As with previous districts, Form B listings were assumed to be correct (manual check of a small sample of prescriptions was inconclusive for 40% of blocks in the sample).

Given the wide range of forest types and biogeoclimatic subzones and variants found in the Kootenay Lake District, it is likely that there is significant potential for increasing the amount of partial cutting used. Wood supply in this district is quite highly constrained by visual concerns and other non-timber values, and the use of alternative silvicultural systems could play a prominent role in mitigating some of the land use conflicts.

TABLE 23. Breakdown of past logging by silvicultural system and analysis unit for Kootenay Lake District licensees. Note: Analysis units used are based on Regional Protocol.

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit (Regional Class.)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	8 584	83%			
			1 - Fd,Lw,Py - G/M	650	8%
			3 - Hw,Cw - G/M	206	2%
			4 - Hw,Cw - P	30	0%
			5 - Sx,Bl - G/M	560	7%
			6 - Sx,Bl - P	43	1%
			7 - Pl,(PwPa) - G/M	584	7%
			8 - Pl,(PwPa) - P	36	0%
			Unspecified	6 475	75%
Group Seedtree	37	0%			
			Unspecified	37	100%
Uniform Seedtree	1 080	10%			
			1 - Fd,Lw,Py - G/M	190	18%
			3 - Hw,Cw - G/M	64	6%
			5 - Sx,Bl - G/M	50	5%
			7 - Pl,(PwPa) - G/M	84	8%
			Unspecified	692	64%
Group Selection	238	2%			
			1 - Fd,Lw,Py - G/M	51	21%
			2 - Fd,Lw,Py - P	19	8%
			5 - Sx,Bl - G/M	20	8%
			6 - Sx,Bl - P	9	4%
			7 - Pl,(PwPa) - G/M	20	8%
			Unspecified	119	50%
Single-tree Selection	250	2%			
			1 - Fd,Lw,Py - G/M	22	9%
			5 - Sx,Bl - G/M	85	34%
			7 - Pl,(PwPa) - G/M	6	2%
			8 - Pl,(PwPa) - P	10	4%
			Unspecified	127	51%
Group Shelterwood	29	0%			
			1 - Fd,Lw,Py - G/M	15	52%
			3 - Hw,Cw - G/M	14	48%
Uniform Shelterwood	90	1%			
			1 - Fd,Lw,Py - G/M	56	62%
			2 - Fd,Lw,Py - P	25	28%
			3 - Hw,Cw - G/M	8	9%
			Unspecified	1	1%
Total Logging	**10 308**	100%			

TABLE 24. Breakdown of past logging by analysis unit and silvicultural system for Kootenay Lake District Licensees. Note: Analysis units used are based on Regional Protocol.

Analysis Unit	*Area (ha) Logged*	*% Total. Logged*	*Silvicultural System*	*Area (ha) Logged*	*% of AU*
AU 1	984	10%			
Fd,Lw,Py - G/M			Clearcut	650	66%
			Uniform Seedtree	190	19%
			Group Selection	51	5%
			Single-tree Selection	22	2%
			Group Shelterwood	15	2%
			Uniform Shelterwood	56	6%
AU 2	44	0%			
Fd,Lw,Py - P			Group Selection	19	43%
			Uniform Shelterwood	25	57%
AU 3	292	3%			
Hw,Cw - G/M			Clearcut	206	71%
			Uniform Seedtree	64	22%
			Group Shelterwood	14	5%
			Uniform Shelterwood	8	3%
AU 4	30	0%			
Hw,Cw - P			Clearcut	30	100%
AU 5	715	7%			
Sx,Bl - G/M			Clearcut	560	78%
			Uniform Seedtree	50	7%
			Group Selection	20	3%
			Single-tree Selection	85	12%
AU 6	52	1%			
Sx,Bl - P			Clearcut	43	83%
			Group Selection	9	17%
AU 7	694	7%			
Pl,(PwPa) - G/M			Clearcut	584	84%
			Uniform Seedtree	84	12%
			Group Selection	20	3%
			Single-tree Selection	6	1%
AU 8	46	0%			
Pl,(PwPa) - P			Clearcut	36	78%
			Single-tree Selection	10	22%
Unspecified AU	7 451	72%			
			Clearcut	6 475	87%
			Group Seedtree	37	0%
			Uniform Seedtree	692	9%
			Group Selection	119	2%
			Single-tree Selection	127	2%
			Uniform Shelterwood	1	0%
Total Logging	**10 308**	100%			

3.7 REVELSTOKE DISTRICT

3.7.1 SBFEP

ISIS records for the Revelstoke District SBFEP show no partial cutting from 1988 to the present. Approximately 2300 ha have been logged in the district since 1988 and in all cases this has been clearcut logging. The two most recently logged blocks on record (harvested in late 1995 and early 1996) are clearcuts with reserves. A phone conversation with Bill Beard, a Zone Forester in the Revelstoke District, indicated that these records are likely reasonable. He did not know of any partial cutting in the district since 1988. Beard noted that many of the prescriptions being developed at present in the district will use small patch cuts and group selection cuts to meet various constraints such as caribou habitat. Beard feels that many of the stands in the district are not very well suited to individual-tree selection logging or other types of partial cutting because of their age and species composition (predominantly decadent old Cw, Hw types). Two areas, Begbie Falls and Dolan Creek are designated as selection management areas in the TSR analysis, because of public concern, but little or no development has occurred in these areas to date. The Begbie Falls area may have more options for applying alternative silvicultural systems because it is predominantly second-growth forest.

The following table shows a breakdown of past logging in Revelstoke District (since 1988) according to analysis unit. As noted above, all logging used a clearcut silvicultural system. Given the absence of alternative silvicultural systems used, no table showing analysis units by silvicultural system is given.

TABLE 25. Breakdown of past logging by silvicultural system and analysis unit for Revelstoke District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	2 324	100%			
			1-Fd,Lw,Pine-G/M	166	7%
			3 - Cw - G/M	538	23%
			4 - Cw - P	64	3%
			5 - Hw (pure) - All	31	1%
			6 - Hw (mix) - G/M	823	35%
			7 - Hw (mix) - P	207	9%
			8 - Sx/Bl - G/M	190	8%
			9 - Sx/Bl - P	59	3%
			Unspecified	246	11%
Total Logging	2 324	100%		2 324	

3.7.2 Licensees

Only 8 276 ha have been logged by licensees in the Revelstoke Forest District over the past 8 years. All of this, with the exception of three blocks (combined area 237 ha) was logged using clearcut systems. The three single-tree selection blocks are all located in AU 8 (spruce and/or balsam types on good or medium sites).

TABLE 26. Breakdown of past logging by silvicultural system and analysis unit for Revelstoke District Licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Analysis Unit (lead spp. + site)*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	8 019	97%			
			1-Fd,Lw,Pine-G/M	141	2%
			3 - Cw - G/M	926	12%
			4 - Cw - P	11	0%
			5 - Hw (pure) - All	21	0%
			6 - Hw (mix) - G/M	930	12%
			7 - Hw (mix) - P	82	1%
			8 - Sx/Bl - G/M	700	9%
			9 - Sx/Bl - P	27	0%
			Unspecified	5 181	65%
Single-tree Selection	237	3%			
			8 - Sx/Bl - G/M	237	100%
Unspecified	20	0%			
			Unspecified	20	100%
Total Logging	8 276	100%			

As shown in Table 26, very little of the licensee (or SBFEP) logging in Revelstoke District occurs in forest types / analysis units that are traditionally considered suitable for partial cutting (such as Fd,Lw,pine types). However, licensees and SBFEPs in other districts have experimented with partial cuts in a number of the forest types found in Revelstoke District, and there may be some precedence for using partial cuts in some of these units. Small-scale trials of alternative silvicultural systems are suggested to determine the potential for such systems, especially group shelterwood or group selection systems.

4.0 DISCUSSION

The ISIS and MLSIS database analysis for the seven districts in the Nelson Forest Region generated a number of interesting results in terms of logging patterns over the past 8 years. It also raised a number of issues about the collection and tracking of silvicultural systems data.

In terms of results, three of the seven districts in the region (Golden, Kootenay Lake, and Revelstoke) do very little partial cutting, and the remaining four districts (Arrow, Boundary, Cranbrook, and Invermere) use quite a variety of silvicultural systems. However, closer examination shows that even in the districts with greater use of partial cutting, the majority of silvicultural systems used are low- or no-volume retention ones (clearcutting or seedtree cuts) with much less representation of higher-volume retention systems such as uniform shelterwoods or single-tree selection cuts. Even in forest types (analysis units) where high-volume retention partial cutting is commonly used, there are often substantial amounts of clearcut and seedtree systems used.

Another interesting trend seen in the analysis is that the cutting profile of the Small Business Forest Enterprise Program over the past 8 years has included a greater proportion of higher-volume retention silvicultural systems (on an area basis) than the cutting profile for licensees. However, in both cases, there is substantial room for increased application of alternative partial-cutting systems that retain more volume. Greater application of these systems (various types of shelterwood and selection cuts) could be a very useful tool in mitigating the effects of various harvesting constraints including adjacency rules and non-timber values.

Discussions with a number of licensee and Small Business Program Foresters throughout the region in 1995 suggested that the introduction of the Forest Practices Code would likely be a catalyst leading to greater use of non-clearcut silvicultural systems. Many of the foresters interviewed indicated that they were already beginning to develop more and more partial-cutting prescriptions. Therefore, the numbers presented in this report may not be truly reflective of the degree of current partial cutting, and this should be kept in mind when reviewing the summary tables. Table 27 provides a summary of the various silvicultural systems used by licensees and the Small Business Program for each of the districts in the Nelson Forest Region over the past 8 years.

It is important to caution that although a variety of silvicultural systems have been used in various forest types, in various districts, there has been little work done to judge the success of these treatments in terms of regeneration, post-harvest stand structure, susceptibility to disease, rates of growth, or other parameters that may be of interest to forest managers and that may have implications for future harvest levels. If the increased use of higher-volume retention partial-cutting systems is to be promoted, an extensive retrospective study needs to be undertaken in each district to determine the success of various systems to date in the different analysis units in which they are applied. It is especially important to monitor the success of partial-cutting systems that are applied in

analysis units in which they area rarely prescribed. Other critical areas in which a range of partial-cutting systems needs to be tested include higher-risk root disease areas and old/decadent forest types. This will help determine the potential for the use of various systems in situations for which we have little past experience. Results of small trials in areas such as these can then be extended to other districts or licensees with similar forest types and similar management problems.

It is difficult to show a regional summary of silvicultural systems use by analysis unit since the units used in this report are district-specific analysis units (with the exception of Kootenay Lake). In general, however, moderate amounts of partial cutting are done in the drier and/or seral types throughout the Nelson Forest Region (Fd, Lw, pine types), whereas little or no partial cutting is done in the wetter and/or climax forest types (Cw, Hw, Sx, Bl types). The exceptions to this appear to be the Golden SBFEP, which appears to practice predominantly clearcut logging even though 40% of its cut over the past 8 years came from the Fd, Pine, Lw type, and Arrow District (both licensees and SBFEP) where partial-cutting systems such as shelterwoods and selection cuts were applied to some degree in most analysis units, including Sx,Bl and Cw,Hw types. There is some uncertainty as to the accuracy of the labels given to a number of these cuts. However, whether listed as shelterwood systems or selection systems, it is likely that these areas have moderate to high levels of volume retention post-harvest. (see Tables 1–26).

The issues raised by the analysis, in terms of data collection and tracking, stem for the most part from database deficiencies that became obvious part way through the process. These deficiencies include substantial amounts of missing information in certain fields, outdated information, incorrect or questionable data, and occasional missing records. Discussions with Business Design Branch staff provided explanations for the first two of these problems. The missing information in certain fields is due to the fact that only certain information is required on the final Form B, which is used for submission of harvest information to Silviculture Branch on completion of harvest activities. Information such as previous type identification and silvicultural system is voluntary rather than required. However, in order to track harvest activities and land base utilization over time, these fields should be mandatory, and a change in reporting requirements to cover this would not add a significant burden to licensee workloads. The outdated information is a result of changes made several years ago to the biogeoclimatic ecosystem classification system used in the NFR. Information stored in ISIS and MLSIS prior to that time mostly still uses the old nomenclature. Time should be taken to convert this information to the newer system so that it can be used for analysis purposes.

Explanations were harder to come by for the incorrect data listings and the missing records. The FTAS silvicultural system data stored in MLSIS should match those provided in the Form B MLSIS listings. FTAS records are generated at the start of harvest activities and the silvicultural system listing should reflect the approved PHSP/SP. The Form B listings are submitted by the licensee following completion of harvest and should also reflect the intent of the PHSP/SP. Attempts to verify some of the information provided in the databases were often confounded by poor prescriptions.

Many of the prescriptions that were reviewed, especially the more complex ones, were inconsistent or did not provide enough information by which to judge the silvicultural system name being applied to a prescription:

- Inventory labels were often missing (or, if present, often appeared to be taken from forest cover maps rather than from cruise information), making it difficult to get an accurate picture of the pre-harvest stand.

- A good description of the management regime being proposed was often missing, so it was difficult to judge long-term activities on a site. In order to distinguish between shelterwood and selection systems, a prescription must include future pass information indicating whether the block will be managed as an even-aged or uneven-aged stand.

- Silvicultural systems nomenclature was often inconsistent or incorrect. For example: blocks that were clearcut except for occasional leave trees were sometimes classified as clearcuts (with reserves), and other times classified as seedtree blocks (even though leave trees were not necessarily for seed purposes); blocks were often classified as selection cuts because pine was being selected for; however, the prescription would then also indicate that the block was being managed under an even-aged system with remaining stems being removed in a second pass (a shelterwood system).

- Silvicultural systems variant modifiers were often missing from a prescription and it was difficult to determine whether or not a prescription described a group or uniform/single-tree system.

It is possible that some of the problems encountered with prescriptions and silvicultural systems nomenclature are to some degree a function of trying to look back over an 8 year period, over which time significant changes have been made in areas such as prescriptions. However, some of the deficiencies were found in some of the more recent prescriptions as well as in older ones. It is possible that the new Forest Practices Code Silvicultural Systems Guidebook will lead to more consistent terminology for silvicultural systems. Unfortunately, though the system provided in the guidebook works well for most prescriptions, some of the more complex prescriptions will always be difficult to label using the standard system. For example, where a prescription is written to deal with a very diverse stand/block, activities may vary (in terms of final stand structure), depending on exactly which part of the stand is in question. It is often difficult to come up with a single silvicultural systems category and variant to describe the silvicultural system for the entire stand/block. Trees will be removed in groups in some places, individually in others; some parts may end up equivalent to small patch cuts, whereas others may remain fairly heavily treed. This is especially common in prescriptions developed for beetle control (such as pine removal).

The problem with missing records (i.e., records that only showed up in one of several database locations) is generally quite infrequent (<5% of openings). However, it could

have implications in terms of triggering regeneration delay periods and accuracy of Ministry of Forests Annual Reports. Business Design Branch staff suggest that this is a district level reporting problem rather than something that can be dealt with at the branch level. It seems reasonable to expect that blocks would be tracked over time, and that blocks in which harvesting was initiated but that do not show a harvest end date would be flagged at some point so the district could look into the progress of activities. Likewise, a block for which final harvest information was received but that had no obvious record of the start of activities should automatically be flagged.

In order to improve the results of future Timber Supply Reviews, it is critical that wherever possible they be based on accurate and comprehensive information about past and current harvesting activities, rather than on assumptions. This will provide modellers and analysts with a reliable picture of where we stand at present so they can more successfully model future timber supplies and develop appropriate cutting levels.

TABLE 27. Summary of partial cutting (1988 to the present) in the Nelson Forest Region by district and tenure

District	Tenure	Area (ha) Logged	Silvicultural System	Area (ha) Logged	% of cut
Arrow					
	SBFEP	3 121			
			Clearcut	1 282	41%
			Uniform Seedtree	238	8%
			Group Selection	154	5%
			Single-tree Selection	1 356	43%
			Uniform Shelterwood	91	3%
	Licensee	32 278			
			Clearcut	27 352	85%
			Group Seedtree	111	0%
			Uniform Seedtree	1 090	3%
			Group Selection	1 931	6%
			Single-tree Selection	571	2%
			Uniform Shelterwood	1 054	3%
			Group Shelterwood	169	1%
Boundary					
	SBFEP	10 938			
			Clearcut	3 528	32%
			Uniform Seedtree	4 272	39%
			Group Selection	142	1%
			Single-tree Selection	2 827	26%
			Uniform Shelterwood	64	1%
			Immature Cut	105	1%
	Licensee	23 795			
			Clearcut	11 007	46%
			Group Seedtree	103	0%
			Uniform Seedtree	10 999	46%
			Group Selection	1 031	4%
			Single-tree Selection	577	2%
			Shelterwood	78	0%
Cranbrook					
	SBFEP	8 733			
			Clearcut	1 752	20%
			Group Seedtree	194	2%
			Uniform Seedtree	3 088	35%
			Group Selection	84	1%
			Single-tree Selection	2 334	27%
			Group Shelterwood	178	2%
			Uniform Shelterwood	1 103	13%
	Licensee	24 824			
			Clearcut	11 884	48%
			Uniform Seedtree	7 059	28%
			Group Selection	4 956	20%
			Single-tree Selection	273	1%
			Group Shelterwood	84	0%
			Uniform Shelterwood	568	2%

TABLE 27 (continued).

District	Tenure	Area (ha) Logged	Silvicultural System	Area (ha) Logged	% of cut
Golden					
	SBFEP	1 646			
			Clearcut	1 489	90%
			Uniform Seedtree	57	3%
			Single-tree Selection	100	6%
	Licensee	9 786			
			Clearcut	9 340	95%
			Uniform Seedtree	199	2%
			Group Selection	173	2%
			Uniform Shelterwood	23	0%
			Unspecified	51	1%
Invermere					
	SBFEP	4 550			
			Clearcut	1 676	37%
			Uniform Seedtree	1 243	27%
			Group Selection	39	1%
			Single-tree Selection	765	17%
			Group Shelterwood	65	1%
			Uniform Shelterwood	762	17%
	Licensee	21 401			
			Clearcut	12 685	59%
			Group Seedtree	114	1%
			Uniform Seedtree	4 080	19%
			Group Selection	709	3%
			Single-tree Selection	1 532	7%
			Group Shelterwood	219	1%
			Uniform Shelterwood	2 062	10%
Kootenay Lake					
	SBFEP	3 835			
			Clearcut	3 118	81%
			Group Seedtree	28	1%
			Uniform Seedtree	376	10%
			Single-tree Selection	306	8%
			Uniform Shelterwood	7	0%
	Licensee	10 308			
			Clearcut	8 584	83%
			Group Seedtree	37	0%
			Uniform Seedtree	1 080	10%
			Group Selection	238	2%
			Single-tree Selection	250	2%
			Group Shelterwood	29	0%
			Uniform Shelterwood	90	1%
Revelstoke					
	SBFEP	2 324			
			Clearcut	2 324	100%
	Licensee	8 276			
			Clearcut	8 019	97%
			Single-tree Selection	237	3%
			Unspecified	20	0%

5.0 CONCLUSIONS

The ISIS/MLSIS database analysis for the various districts in the Nelson Forest Region showed substantial differences both within and among districts in the application of partial-cutting systems. Within a district, a variety of silvicultural systems are often used in a particular analysis unit or biogeoclimatic subzone/variant. This is likely the result of different land use constraints that dictate what is acceptable on a particular site. Among districts, the differences in the application of silvicultural systems may be to some extent due to district attitudes and management styles, as well as to forest type composition.

Root disease concerns appear to be a significant factor limiting the application of partial-cutting systems on a more widespread basis in some districts (Golden and Kootenay Lake). However, in other districts partial-cutting systems are applied in a wide variety of analysis units / biogeoclimatic subzones, even those indicated as being high hazard areas according to the Root Disease Management Guidebook (Arrow, Invermere).

In several districts there are concerns about whether or not it is feasible or appropriate to partially cut overmature forest types. Revelstoke and Kootenay Lake in particular have significant areas of overmature cedar-hemlock forest types that may present problems for some forms of partial cutting. Options for these types may be limited to systems such as group selection; however, other systems could be tested on a small-scale, trial basis to determine suitability.

In general, districts that currently use little partial cutting (Golden, Revelstoke, Kootenay Lake) may have good potential for increasing the application of partial-cutting silvicultural systems, and therefore mitigating AAC reductions. However, even districts that currently use a variety of silvicultural systems throughout their land base (Invermere, Cranbrook, Boundary, Arrow) have potential for additional use of alternative silvicultural systems. These districts generally use either clearcut systems or low-volume retention systems (seedtree) on more than 50% of their land base. These systems do not help reduce adjacency constraints, and generally are not considered appropriate for protecting non-timber values. A shift towards lower proportions of these systems will allow the districts more flexibility in harvest scheduling and more access to highly constrained areas.

Districts with a greater proportion of high-volume retention silvicultural systems may also tend to have a greater area logged because, in order to remove an equivalent volume, more area must be harvested than would be required with clearcut systems. This has a number of implications including increased initial development costs, increased harvesting costs, and increased maintenance. These disadvantages must be weighed against the potential benefits of a shift towards more partial cutting. In general, a good mix of systems is likely the most effective option, with considerable attention given to where each system is applied. Harvest schedule models would be a very useful tool for achieving this and would provide a much better overall development plan than that provided by planning and prescribing on a block-by-block basis.

APPENDIX 1

ANALYSIS UNIT CLASSIFICATION SYSTEM FOR EACH DISTRICT

(Includes listing of Inventory Type Groups and Regional Analysis Unit Protocol)

TABLE A-1.1. Analysis unit characteristics for Arrow TSA[1]

Analysis unit	Species groups	Inventory type groups	Site index classes	Biogeoclimatic zone
01	Douglas-fir, larch, ponderosa pine	1-8, 32-34	good & medium	N/A
02	Douglas-fir, larch, ponderosa pine	1-8, 32-34	poor	N/A
03	spruce	21-26	good & medium	N/A
04	spruce	21-26	poor	N/A
05	hemlock, cedar	9-17	good & medium	N/A
06	hemlock, cedar	9-17	poor	N/A
07	lodgepole pine, whitebark & white pine	27-31	good & medium	N/A
08	lodgepole pine, whitebark & white pine	27-31	poor	N/A
09	balsam (high elevation)	18-20	N/A	ESSF
10	balsam	18-20	N/A	ICH

TABLE A-1.2. Analysis unit characteristics for Boundary TSA[2]

Analysis unit	Species groups	Inventory type groups	Site index classes	Age/height/ stocking class	Stocking class
01	Douglas-fir, larch, yellow pine	1-8, 32-34	good & medium	any	any
02	Douglas-fir, larch, yellow pine	1-8, 32-34	poor	any	any
03	cedar, hemlock, white pine	9-17,27	good & medium	any	any
04	cedar, hemlock, white pine	9-17,27	poor	any	any
05	spruce, balsam	18-26	good & medium	any	any
06	spruce, balsam	18-26	poor	any	any
07	lodgepole pine (pure stands)	28	good & medium	any	any
08	lodgepole pine (pure stands)	28	poor	any	any
09	lodgepole pine (mixed stands)	29-31	good & medium	any	any
10	lodgepole pine (mixed stands)	29-31	poor	any	any
11	lodgepole pine (dense stands)	28-31	good & medium	310,410,420	3
12	lodgepole pine (dense stands)	28-31	poor	310,410,420[a]	3

(a) Only 50% of these stands were included.

[1] B.C. Ministry of Forests. 1994. Arrow TSA timber supply analysis. Victoria, B.C.

[2] B.C. Ministry of Forests. 1994. Boundary TSA timber supply analysis. Victoria, B.C.

TABLE A-1.3. Analysis unit characteristics for Cranbrook TSA[3]

Analysis unit	Species description	Site class	Inventory type groups	Comments
1	Pl (pure)	G,M	28	
2	Pl (pure)	P	28	
3	Pl (leading)	G,M	29-31	
4	Pl (leading)	P	29-31	
5	Pl (age class 3)	G,M,P	28-31	
6	SB types, Pw, Pa, FS	G,M	4, 18-27	
7	SB types, Pw, Pa, FS	P	4, 18-27	
8[a]	CH types, FC, FH	G,M,P	2, 3, 9-17	
10	FPy,Py	G,M	6, 32	
11	FPy,Py	P	6, 32	
12	FPy,Py,F,FPl	L	1, 5, 6, 32	trench low sites
13	FL types, FPl	G,M	1, 5, 7, 8, 33, 34	
14	FL types, FPl	P	1, 5, 7, 8, 33, 34	
15	High elevation sites	G,M,P	all	elevation >1800 m
20	Forage area	all	1-34	
21	Forage area	all	1-34	0 volume

(a) Initially, two analysis units were defined for CH types, FC, and FH: one, comprising good and medium sites, the other, poor sites. These units were subsequently combined. Some tables listed later in this appendix show the separated analysis units, numbered 8 and 9.

TABLE A-1.4. Analysis unit characteristics for Golden TSA[4]

Inventory type groups	Major species	Site class
9-26	Redcedar, hemlock, balsam, spruce	Good, medium
9-26	Redcedar, hemlock, balsam, spruce	Poor
1-8, 27-32	Douglas-fir, all pine (larch)	Good, medium
1-8, 27-32	Douglas-fir, all pine (larch)	Poor

[3] B.C. Ministry of Forests. 1995. Cranbrook TSA timber supply analysis. Victoria, B.C.
[4] B.C. Ministry of Forests. 1993. Golden TSA timber supply review. Victoria, B.C.

TABLE A-1.5. Analysis unit characteristics for Kootenay Lake TSA[5]

Management zone	Analysis unit	Inventory type group	Site quality[a]	Existing age range (years)
Deer/Elk winter range	1	F L Py Pw	GMP	All
		C H	GMP	
		S B	GMP	
	4	Pl Pa	GMP	All
Caribou late winter range	5	F L Py Pw	GMP	≥ 140
		Pl Pa		
	6	F L Py Pw	GMP	< 140
		Pl Pa		
	7	C H	GMP	≥ 140
		S B		
	8	C H	GMP	< 140
		S B		
Moose/Caribou early winter range	9	F L Py Pw	GMP	All
		Pl Pa	GMP	All
	11	C H	GMP	≥ 140
		S B		
	12	C H	GMP	< 140
		S B		
Moose/Caribou winter range	13	F L Pw Py	GMP	All
		Pl Pa		
	15	C H	GMP	≥ 140
		S B		
	16	C H	GMP	< 140
		S B		
VQO M	17	F L Pw Py	GMP	All
		Pl Pa		
	19	C H	GMP	≥ 140
		S B		
	20	C H	GMP	< 140
		S B		

[a] G - Good; M - Medium; P - Poor; L - Low.

[5] B.C. Ministry of Forests. 1993. Kootenay Lake TSA timber supply review. Victoria, B.C.

TABLE A-1.5 continued.

Management zone	Analysis unit	Inventory type group	Site quality[a]	Existing age range (years)
VQO PR	21	F L Pw Py	GM	≥ 140
	22	F L Pw Py	GM	< 140
	23	C H	GMP	≥ 140
	24	C H	GMP	< 140
	25	S B	GMP	≥ 140
	26	S B	GMP	< 140
	27	F L Pw Py Pl Pa	P GMP	All
VQO R	29	F L Pw Py Pl Pa	GMP	≥ 140
	30	F L Pw Py Pl Pa	GMP	< 140
	31	C H S B	GMP	≥ 140
	32	C H S B	GMP	<140
Watershed class 1-3	33	F L Pw Py	GM	≤ 40
	34	F L Pw Py	GM	< 140
	35	C H	GMP	≥ 140
	36	C H	GMP	< 140
	37	S B	GMP	≥ 140
	38	S B	GMP	< 140
	39	F L Pw Py Pl Pa	P GMP	All
Watershed class 4	41	F L Pw Pa Pl Pa	GMP	All
	43	C H	GMP	≥ 140
	44	C H	GMP	< 140
	45	S B	GMP	≥ 140
	46	S B	GMP	< 140

[a] G - Good; M - Medium; P - Poor; L - Low.

TABLE A-1.5 continued.

Management zone	Analysis unit	Inventory type group	Site quality[a]	Existing age range (years)
Watershed class 5	47	F L Pw Py	GM	All
	49	C H	GMP	≥ 140
	50	C H	GMP	< 140
	51	S B	GMP	≥ 140
	52	S B	GMP	< 140
	53	F L Pw Py Pl Pa	P GMP	All
Watershed class 6	55	F L Pw Pa	GM	All
	57	C H	GMP	≥ 140
	58	C H	GMP	< 140
	59	S B	GMP	≥ 140
	60	S B	GMP	< 140
	61	F L Pw Py Pl Pa	P GMP	All

[a] G - Good; M - Medium; P - Poor; L - Low.

TABLE A-1.6. Analysis unit characteristics for Invermere TSA[6]

Analysis unit	Species groups	Inventory type groups	Site index classes	Area within timber harvesting land base (hectares)
01	Douglas-fir, larch, yellow pine	1-8, 32-34	good	9 548.7
02	Douglas-fir, larch, yellow pine	1-8, 32-34	medium	51 618.8
03	Douglas-fir, larch, yellow pine	1-8, 32-34	poor	28 844.1
04	Douglas-fir, larch, yellow pine	1-8, 32-34	low	2 006.6
05	spruce, balsam	18-26	good	4 419.3
06	spruce, balsam	18-26	medium	18 162.9
07	spruce, balsam	18-26	poor	15 102.0
08	cedar, hemlock	09-17	all	510.4
09	lodgepole pine , white pine	27-31	good	23 669.9
10	lodgepole pine , white pine	27-31	medium	58 276.4
11	lodgepole pine , white pine	27-31	poor	20 230.5
12	deciduous	35-42	all	1 370.3
Total				233 759.9

TABLE A-1.7. Analysis unit characteristics for Revelstoke TSA[7]

Analysis Unit	Species Groups	Inventory Type Groups	Site Index Classes
1	fir/larch/pine	1-8, 27-34	good & medium
2	fir/larch/pine	1-8, 27-34	poor
3	cedar	9-11	good & medium
4	cedar	9-11	poor
5	pure hemlock	12	all sites
6	hemlock	13-17	good & medium
7	hemlock	13-17	poor
8	spruce/balsam	18-26	good & medium
9	spruce/balsam	18-26	poor
10	all (coniferous)	1-34	all

[6] B.C. Ministry of Forests. 1995. Invermere TSA timber supply analysis. Victoria, B.C.
[7] B.C. Ministry of Forests. 1993. Revelstoke TSA timber supply analysis. Victoria, B.C.

APPENDIX 2

BREAKDOWN OF PAST LOGGING BY SILVICULTURAL SYSTEM AND BIOGEOCLIMATIC SUBZONE/VARIANT (FOR SBFEP AND LICENSEES IN EACH DISTRICT)

TABLE 2-1. Breakdown of Past Logging by Silvicultural System and Biogeoclimatic Subzone/Variant for Arrow District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1281	41%			
			ESSFwc1	38	3%
			ESSFwc4	57	4%
			ICHdw	99	8%
			ICHmw2	1026	80%
			ICHwk1	61	5%
Uniform Seedtree	237	8%			
			ICHdw	48	20%
			ICHmw2	189	80%
Group Selection	155	5%			
			ESSFwc1	127	82%
			ICHmw2	28	18%
Single-tree Selection	1355	43%			
			ESSFwc1	79	6%
			ICHdw	319	24%
			ICHmw2	957	71%
Uniform Shelterwood	91	3%			
			ICHmw2	91	100%
Total Logging	**3119**	**100%**			

TABLE 2-2. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Arrow District licensees

Silvicultural System	*Area (ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	27352	85%			
			ESSFc **	2353	9%
			ESSFwc1	9795	36%
			ESSFwc4	1121	4%
			ICHdw	1304	5%
			ICHmw1 *	1309	5%
			ICHmw2	10557	39%
			ICHwk1	594	2%
			Unspecified	319	1%
Group Seedtree	111	0%			
			ESSFwc1	19	17%
			ICHdw	48	43%
			ICHmw2	44	40%
Uniform Seedtree	1090	3%			
			ESSFwc1	21	2%
			ICHdw	387	36%
			ICHmw2	682	62%
Group Selection	1931	6%			
			ESSFwc1	261	14%
			ESSFwc4	50	3%
			ICHdw	243	13%
			ICHmw2	1259	65%
			IDFmw1	14	1%
			Unspecified	103	5%
Single-tree Selection	571	2%			
			ESSFc **	50	9%
			ESSFwc1	160	28%
			ESSFwc4	74	13%
			ICHdw	43	8%
			ICHmw2	185	32%
			Unspecified	59	10%
Uniform Shelterwood (includes natural and irregular shelterwoods)	1054	3%			
			ESSFwc1	209	20$
			ESSFwc4	117	11%
			ICHdw	55	5%
			ICHmw2	612	58%
			Unspecified	60	6%
Group Shelterwood	169	1%			
			ICHdw	9	5%
			ICHmw2	160	95%
Total Logging	32278	100			

* Shown as ICHmw1 in MLSIS records but this subzone does not exist in Arrow District (should be ICHdw or ICHmw2)
** Old BGC Classification–need elevation and location to correlate with new system

Many of the biogeoclimatic subzone/variant listings are still given in the old nomenclature system. These were not converted to the newer system since direct correlations could not be made and a block-by-block conversion would be time consuming.

TABLE 2-3. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Boundary District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	3528	32%			
			ESSFdc1	740	21%
			ESSFwc4	21	1%
			ICHdw	531	15%
			ICHmk1	953	27%
			ICHmw2	65	2%
			IDFdm1	548	16%
			MSdm1	670	19%
Uniform Seedtree	4272	39%			
			ESSFdc1	65	2%
			ESSFwc4	4	0%
			ICHdw	433	10%
			ICHmk1	962	23%
			ICHmw2	143	3%
			IDFdm1	730	17%
			MSdm1	1935	45%
Group Selection	142	1%			
			ICHmk1	24	17%
			IDFdm1	56	39%
			MSdm1	62	44%
Single-tree Selection	2827	26%			
			ICHdw	71	3%
			ICHmk1	388	14%
			IDFdm1	1904	67%
			MSdm1	464	16%
Uniform Shelterwood	64	1%			
			ICHmk1	42	66%
			IDFdm1	22	34%
Immature Cut	105	1%			
			ICHmk1	36	34%
			MSdm1	69	66%
Total Logging	**10938**	100%			

TABLE 2-4. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Boundary District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	11 007	46%			
			ESSFc*	2375	22%
			ESSFdc1	1995	18%
			ESSFwc4	143	1%
			ICHc*	3096	28%
			ICHdw	128	1%
			ICHmk1	304	3%
			ICHmw2	1831	17%
			IDFdm1	174	2%
			MSdm1	961	9%
Group Seedtree	103	0%			
			ICHmk1	35	34%
			IDFdm1	6	6%
			MSdm1	62	60%
Uniform Seedtree	10 999	46%			
			ESSFc*	682	6%
			ESSFdc1	83	1%
			ICHc*	6427	58%
			ICHdw	195	2%
			ICHmk1	708	6%
			ICHmw2	655	6%
			IDFdm1	768	7%
			MSdm1	1481	13%
Group Selection	1 032	4%			
			ESSFc*	264	26%
			ESSFwc4	7	1%
			ICHc*	396	38%
			ICHmk1	2	0%
			ICHmw2	12	1%
			IDFdm1	351	34%
Single-tree Selection	577	3%			
			ESSFc*	4	1%
			ESSFwc4	5	1%
			ICHmk1	6	1%
			IDFdm1	562	97%
Shelterwood (natural and strip)	78	0%			
			ICHmw2	5	6%
			IDFdm1	58	74%
			MSdm1	15	19%
Total Logging	**23 796**	100%			

* Old BGC Classification system - elevation and location required to convert to new system

TABLE 2-5. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Cranbrook District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1 752	20%			
			ESSFdk	111	6%
			ESSFwm	32	2%
			ICHmk1	57	3%
			ICHmw2	145	8%
			IDFdm2	891	51%
			MSdk	503	29%
			PPdh2	13	1%
Group Seedtree	194	2%			
			IDFdm2	91	47%
			MSdk	70	36%
			PPdh2	33	17%
Uniform Seedtree	3 087	35%			
			ESSFdk	58	2%
			ICHmk1	185	6%
			ICHmw2	30	1%
			IDFdm2	2033	66%
			MSdk	470	15%
			PPdh2	311	10%
Group Selection	84	1%			
			ESSFdk	4	5%
			IDFdm2	56	67%
			MSdk	24	29%
Single-tree Selection	2 333	27%			
			ESSFdk	32	1%
			ICHmk1	16	1%
			IDFdm2	2110	90%
			MSdk	87	4%
			PPdh2	88	4%
Group Shelterwood	178	2%			
			IDFdm2	178	100%
Uniform Shelterwood	1 103	13%			
			ICHmk1	22	2%
			IDFdm2	479	43%
			MSdk	77	7%
			PPdh2	525	48%
Total Logging	8 731	100%			

TABLE 2-6. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Cranbrook District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	11 884	48%			
			ESSFdk	4316	36%
			ESSFwm	1104	9%
			ICHdw	118	1%
			ICHmk1	1042	9%
			ICHmw2	477	4%
			IDFdm2	1377	12%
			MSdk	3452	29%
Uniform Seedtree	7 059	28%			
			ESSFdk	858	12%
			ESSFwm	968	14%
			ICHmk1	374	5%
			ICHmw2	815	12%
			IDFdm2	696	10%
			MSdk	3347	47%
			PPdh2	2	0%
Group Selection	4 956	20%			
			ICHmk1	495	10%
			ICHmw2	191	4%
			IDFdm2	3536	71%
			MSdk	705	14%
			PPdh2	30	1%
Single-tree Selection	273	1%			
			ESSFdk	10	4%
			IDFdm2	145	53%
			MSdk	118	43%
Group Shelterwood	84	0%			
			IDFdm2	84	100%
Uniform Shelterwood	568	2%			
			ICHmk1	83	15%
			ICHmw2	47	8%
			IDFdm2	355	63%
			MSdk	83	15%
Total Logging	24 824	100%			

TABLE 2-7. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Golden District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1 489	90%			
			ESSFwc2	29	2%
			ESSFwm	52	3%
			ICHmk1	233	16%
			ICHmw1	865	58%
			ICHvk1	20	1%
			ICHwk1	155	10%
			IDFdm2	23	2%
			MSdk	112	8%
Uniform Seedtree	57	3%			
			ICHmk1	33	58%
			IDFdm2	24	42%
Single-tree Selection	100	6%			
			ICHmk1	31	31%
			ICHmw1	27	27%
			ICHwk1	10	10%
			IDFdm2	32	32%
Total Logging	**1 646**	100%			

TABLE 2-8. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Golden District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	9 340	95%			
			ESSFdk	109	1%
			ESSFvc	939	10%
			ESSFwc1	130	1%
			ESSFwc2	36	0%
			ESSFwm	1 377	15%
			ICHmk1	202	2%
			ICHmw1	4 069	44%
			ICHmw2	1.2	0%
			ICHvk1	560	6%
			ICHwk1	1 386	15%
			IDFdm2	9.4	0%
			MSdk	521	6%
Uniform Seedtree	199	2%			
			ICHmk1	53	27%
			ICHmw1	146	73%
Group Selection	174	2%			
			ESSFwm	79	45%
			ICHmk1	57	33%
			ICHmw1	38	22%
Uniform Shelterwood	23	0%			
			ICHmw1	11	48%
			MSdk	12	52%
Unspecified	51	1%			
			ICHmw1	29	57%
			ESSFwc2	20	39%
			MSdk	2	4%
Total Logging	9 787	100%			

TABLE 2- 9. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Invermere District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	1 676	37%			
			ESSFdk	869	52%
			ESSFwm	26	2%
			ICHmk1	58	3%
			IDFdm2	377	22%
			MSdk	346	21%
Uniform Seedtree	1 243	27%			
			ESSFdk	271	22%
			ICHmk1	21	2%
			IDFdm2	146	12%
			MSdk	805	65%
Group Selection	39	1%			
			ESSFdk	32	82%
			IDFdm2	7	18%
Single-tree Selection	765	17%			
			ESSFdk	4	1%
			IDFdm2	540	71%
			MSdk	221	29%
Group Shelterwood (incl. strip shelterwood)	65	1%			
			ESSFdk	35	54%
			IDFdm2	30	46%
Uniform Shelterwood (includes irregular	762	17%			
			ICHmk1	62	8%
			IDFdm2	606	80%
			MSdk	94	12%
Total Logging	4 550	100%			

TABLE 2-10. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Invermere District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	12 685	59%			
			ESSFdk	7 162	56%
			ESSFwc1	79	1%
			ESSFwc4	35	0%
			ESSFwm	722	6%
			ICHmk1	317	2%
			ICHmw1	54	0%
			IDFdm2	928	7%
			MSdk	3 388	27%
Group Seedtree	114	1%			
			ICHmk1	14	12%
			MSdk	100	88%
Uniform Seedtree	4 080	19%			
			ESSFdk	533	13%
			ICHmk1	150	4%
			ICHmw1	372	9%
			IDFdm2	490	12%
			MSdk	2 536	62%
Group Selection	709	3%			
			ESSFdk	72	10%
			ICHmk1	9	1%
			IDFdm2	517	73%
			MSdk	111	16%
Single-tree Selection	1 532	7%			
			ESSFdk	152	10%
			IDFdm2	622	41%
			MSdk	758	49%
Group Shelterwood	219	1%			
			IDFdm2	109	50%
			MSdk	110	50%
Uniform Shelterwood (includes natural and irregular Shelterwoods)	2 062	10%			
			ICHmk1	46	2%
			ICHmw1	59	3%
			IDFdm2	203	10%
			MSdk	1 754	85%
Total Logging	21 401	100%			

TABLE 2-11. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Kootenay Lake District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	3 118	81%			
			ESSFwc1	144	5%
			ESSFwc4	72	2%
			ESSFwm	311	10%
			ICHdw	290	9%
			ICHmw2	1 545	50%
			ICHwk1	244	8%
			ICHxw	24	1%
			MSdk	488	16%
Group Seedtree	28	1%			
			ICHdw	28	100%
Uniform Seedtree	375	10%			
			ICHdw	89	24%
			ICHmw2	110	29%
			MSdk	176	47%
Single-tree Selection	306	8%			
			ESSFwm	4	1%
			ICHdw	250	82%
			ICHmw2	52	17%
Uniform Shelterwood	7	0%			
			ICHdw	7	100%
Total Logging	**3 834**	100%			

TABLE 2-12. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Kootenay Lake District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone/Variant*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	8 583	83%			
			ESSFvc	31	0%
			ESSFwc1	351	4%
			ESSFwc4	659	8%
			ESSFwm	2 704	32%
			ICHdw	413	5%
			ICHmk1	10	0%
			ICHmw1	60	1%
			ICHmw2	3 677	43%
			ICHwk1	464	5%
			ICHxw	5	0%
			MSdk	209	2%
Group Seedtree	37	0%			
			ICHmw2	37	100%
Uniform Seedtree	1 080	10%			
			ESSFwm	87	8%
			ICHdw	279	26%
			ICHmw2	411	38%
			MSdk	303	28%
Group Selection	238	2%			
			ESSFwc4	11	5%
			ESSFwm	9	4%
			ICHdw	130	55%
			ICHmw2	77	32%
			ICHxw	11	5%
Single-tree Selection	249	2%			
			ESSFwc1	12	5%
			ESSFwc4	82	33%
			ESSFwm	92	37%
			ICHdw	25	10%
			ICHmw2	38	15%
Group Shelterwood	29	0%			
			ICHmw2	29	100%
Uniform Shelterwood	91	1%			
			ICHdw	78	86%
			ICHmw2	13	14%
Total Logging	**10 307**	100%			

TABLE 2-13. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Revelstoke District SBFEP

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	2 323	100%			
			ESSFvc	167	7%
			ESSFwc1	60	3%
			ESSFwc4	41	2%
			ICHmw2	88	4%
			ICHmw3	115	5%
			ICHvk1	710	31%
			ICHwk1	1 142	49%
Total Logging	2 323	100%			

TABLE 2-14. Breakdown of past logging by silvicultural system and biogeoclimatic subzone/variant for Revelstoke District licensees

Silvicultural System	*Area(ha) Logged*	*% Total Logged*	*Biogeoclimatic Subzone*	*Area (ha) Logged*	*% of Silvi System*
Clearcut	8 018				
			ESSFb *	172	2%
			ESSFvc	1 900	24%
			ESSFwc1/4	206	3%
			ESSFwc2	68	1%
			ICHa2 *	468	6%
			ICHb *	3 491	44%
			ICHc *	21	0%
			ICHmw2	248	3%
			ICHmw3	74	1%
			ICHvk1	972	12%
			ICHwk1	398	5%
Single-tree Selection	237				
			ESSFwc1/4	145	61%
			ICHvk1	92	39%
Unspecified	20				
			ESSFvc	11	55%
			ICHb *	9	45%
Total Logging	8 275	100%			

* Old BGC Classification - need elevation and/or location to correlate with new system

APPENDIX 3

DETAILED LISTING OF OPENING RECORDS FOR SBFEP LOGGING IN EACH DISTRICT

*****COMPUTER DISKS NOT CONTAINED IN THIS COPY******
*****AVAILABLE UPON REQUEST*****

Note: filenames show district abbreviation and analysis type (AU or BGC)
(e.g., DAR-AU.xls = Arrow District, analysis by silvi. system and AU)

APPENDIX 4

DETAILED LISTING OF OPENING RECORDS FOR LICENSEE LOGGING IN EACH DISTRICT

*****COMPUTER DISKS NOT CONTAINED IN THIS COPY******
*****AVAILABLE UPON REQUEST*****

Note: filenames = district abbrev, ML (for MLSIS) and analysis type (AU or BGC)
(e.g., DARMLAU.xls = Arrow District, analysis by silvi. system and AU)